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IN OUR NEXT ISSUE

Do You Think That the Earth Is Solid?

There have been many suppositions made regarding this interesting question. In our next issue, one of our foremost scientific writers will present his views on the subject.

Is a Radio Set a Menace?

Decidedly no, but certain precautions must be taken in the construction and operation of one of them in order to be perfectly safe. An article will tell all about the main hazards of radio.

How Are Theatres Cooled?

Many places of entertainment today are installing elaborate cooling systems for the benefit of their patrons. One of the largest and most efficient of these will be described.

Phonograph Music Like a Band!

A new type of phonograph has been designed that will give volume equal to that of a large orchestra. This is accomplished by means of vacuum tube amplifiers operated from the house current and the system will be described in detail.

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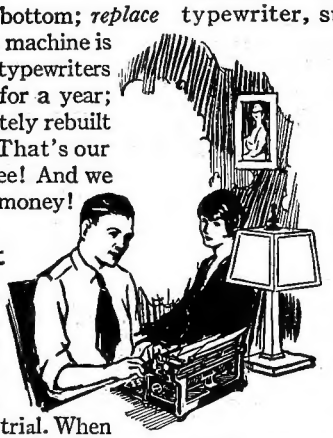

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Volume XIII
Whole No. 150

Science and Invention

October, 1925
No. 6

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"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

What We Don't Know About Radio

By HUGO GERNSBACK

THE new science of Radio is perhaps the most elusive of them all. While radio, of course, comes under electrical engineering, it is subject to so many vagaries, that even the best radio engineer (if there is such an individual), does not care to commit himself when it comes to calculating certain radio effects. Not only are we in ignorance of how to calculate many radio features, but for many of them we have no explanation whatsoever today.

I BELIEVE THAT:

knowledge that has not been experienced can never be real.

There is, first of all, the well-known *fading* effect, which makes itself so noticeable when you receive distant stations, which one minute come in loud and then fade out almost entirely the next. No real explanation that will hold good in ALL instances has ever been given.

We do not even know today whether radio waves are propagated above the ground or below. As far as we know Tesla's idea that the waves are set up in the earth and then leave the earth to go out into open space where their effects are felt, may be correct. Underground radio and short wave radio, where strong signals are received without any aerial at all, from very distant stations, seem to support this theory. Scientists, however, do not care to commit themselves regarding it.

What causes the so-called dead spots? Certain local stations, as every radio fan knows, come in well on your set, while other locals, though more powerful and perhaps nearer to you, come in weak. All distant stations may come in very strong, while stations nearer to you by many miles, although perhaps more powerful, seem weak. In other words you are located in a dead spot in respect to these "weaker" stations. Your radio engineer will tell you glibly that this is the effect of your local conditions, and that near you certain buildings or obstacles absorb the waves of these stations that come in weak, or that you are in the "iron district"; and while this may be a partly-correct answer it does not satisfy. For instance, there are whole sections of the country which, although flat and without obstructions are known as "dead areas." There are several such areas along the Atlantic seaboard, where there are no obstructions at all and where conditions, near the sea water should, if anything, be much better than elsewhere. So the absorption theory does not seem to apply here.

I BELIEVE THAT:

that the greatest obstacle to progress is our mental rut.

How difficult it is to apply reasoning to this sort of thing can best be shown by an illustration that occurs to thousands. Pick out any ideal receiving location where dozens of stations can readily be received. If we contemplate the aerial of such a receiving set, we must say to ourselves that, being located in a good location where stations from every point of the compass come in with good volume, the argument must hold, that if a hundred stations are actually on the air, the waves of these one hundred stations must actually strike the aerial. But is it possible to receive all of these one hundred stations? Certainly not. Why? There is no answer. To say that the station is in a dead spot means nothing—besides it is not correct, as stations from every point of the compass are received very readily. So the dead spot idea does not seem to hold true. Nevertheless, while this ideally-located receiving set will receive dozens of stations, it is not able to receive them all—the reasons we do not know.

I BELIEVE THAT:

that this age will go down in History as the most wasteful of all.

Is your aerial also your ground—and is your ground the aerial—makes a very pretty subject for perfectly good arguments for your radio wiseacres. Consider your radio aerial, which, let us say, is 60 feet long. Then let us consider your ground, which is a wire also 60 feet long, running to the nearest cold water pipe. This is a very common and frequent condition. The waves as they come in naturally strike your aerial and there is no good reason to believe that they do not strike your ground wire as well. Radio waves, as you may know, permeate everything except metals and conductors, and if your ground is located in a brick or wooden building the radio waves must naturally strike the ground wire as well.

Now the ticklish question is, what really happens? Theoretically, in order to complete the circuit, the outgoing wave leaving the broadcast station is supposed to impinge upon your aerial, then slide down through the same to the receiving set, grounding itself through the earth, and returning to the broadcast station's ground. That is your theoretical circuit. But if, as before mentioned, the aerial wave grounds itself on your ground wire, what happens? Nothing, apparently, because this must occur right along and reception is satisfactory. This is merely another thing we do not know about radio.

Although the writer has been engaged in radio research work since 1903, he confesses that he has no explanation for any of the above problems, and, as a matter of fact, admits that he just knows enough to realize that he knows nothing whatsoever about Radio.

But Radio is young as yet, only 25 years old. Naturally, for a new art, this is a very short time, so we need not despair. We shall know a whole lot more about Radio and its mysteries before the close of this century.

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Mr. Hugo Gernsback speaks every Monday at 9 P. M. from Station WRNY on various radio and scientific subjects.

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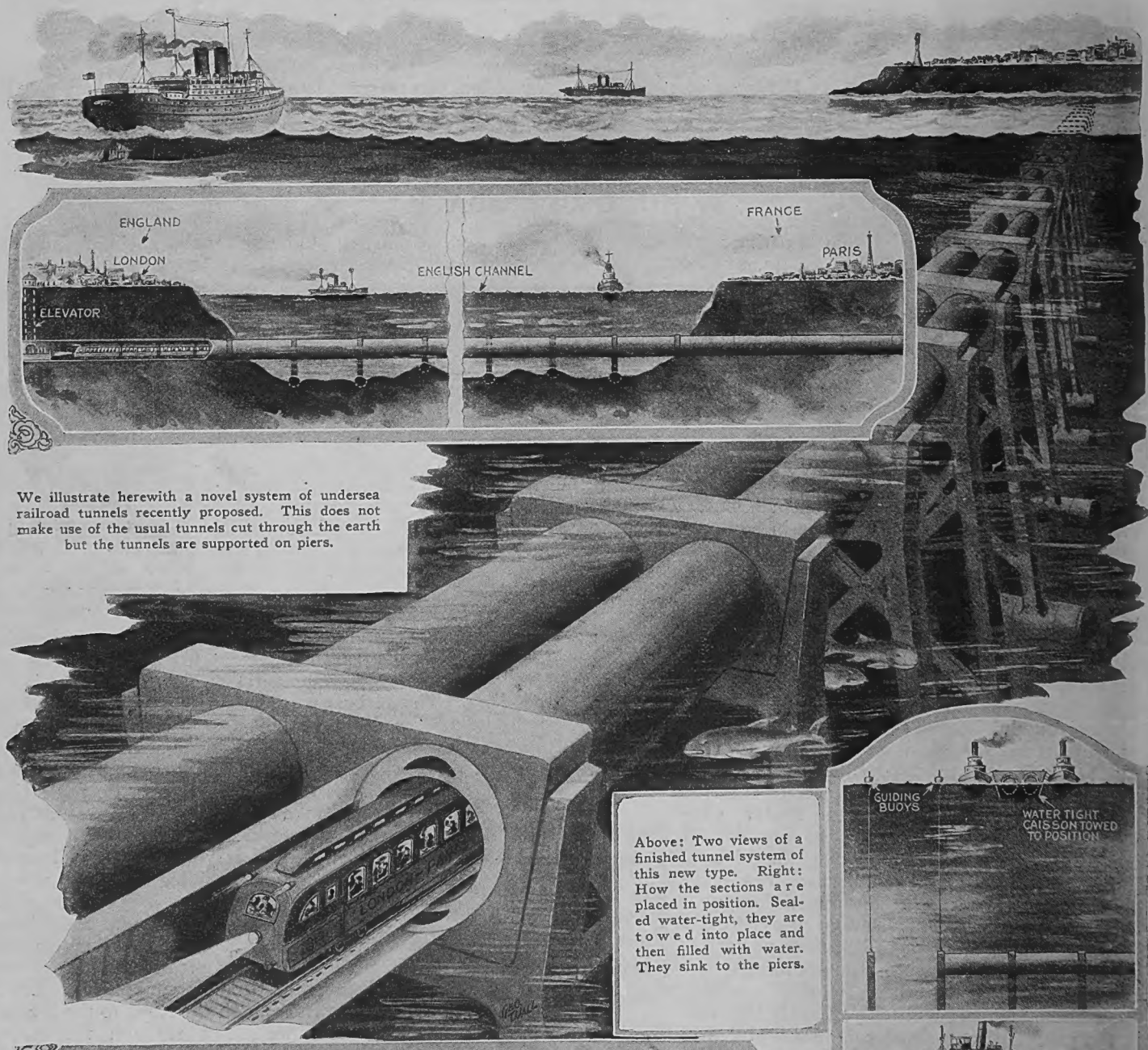
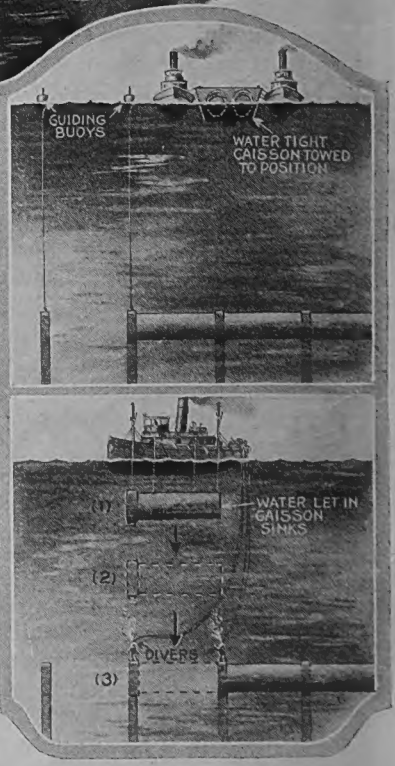
London to Paris by Rail

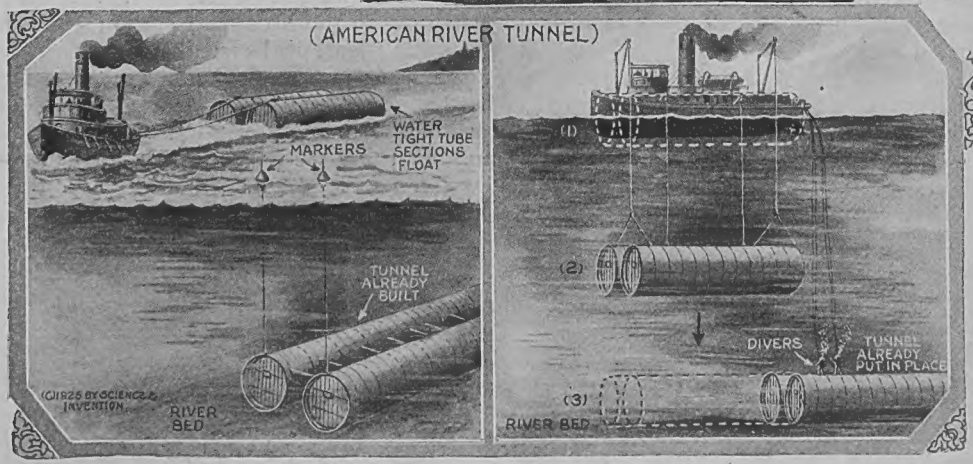
Newly Proposed Sub-aqueous Railway Adapted to Trans-oceanic Requirements



We illustrate herewith a novel system of undersea railroad tunnels recently proposed. This does not make use of the usual tunnels cut through the earth but the tunnels are supported on piers.

Above: Two views of a finished tunnel system of this new type. Right: How the sections are placed in position. Sealed water-tight, they are towed into place and then filled with water. They sink to the piers.





Above is shown one of the American tunnel systems wherein the twin tubes rest on the bottom. Here also the water-tight tube sections are floated into position and sunk. Divers serve to guide the tubes into the desired location after which the abutting ends are sealed together.

In the new scheme for building a railroad under the English channel, it is proposed to first build a series of peculiarly shaped piers as shown above, all piers being in accurate alignment. The caissons are built on shore and made water-tight. They are then towed to position and when water is let in, they sink. The ends are so shaped as to fit into the piers whereupon the new caisson is sealed to that section of the tunnel already in place.

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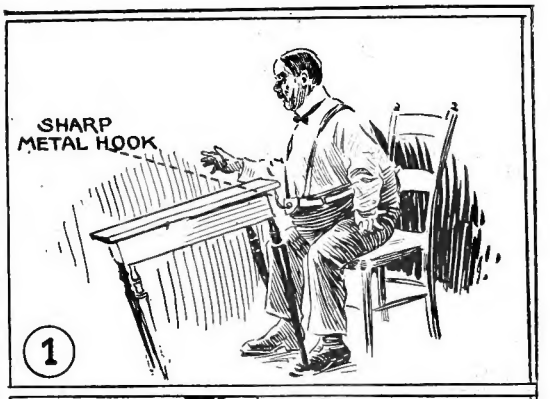
Tricks of Mediums

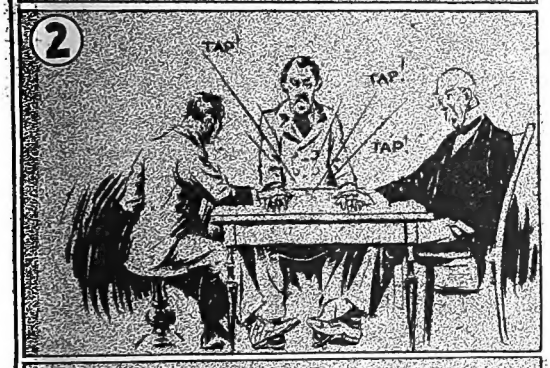
By REV. CRAWFORD TROTTER

Pastor of the Methodist Episcopal Church at Santa Fe Springs, California

A table in the dark room jumps, rocks and dances, although the medium's hands and feet are held by others in the circle. At any moment the lights may be turned on and the table examined for ropes or wires.

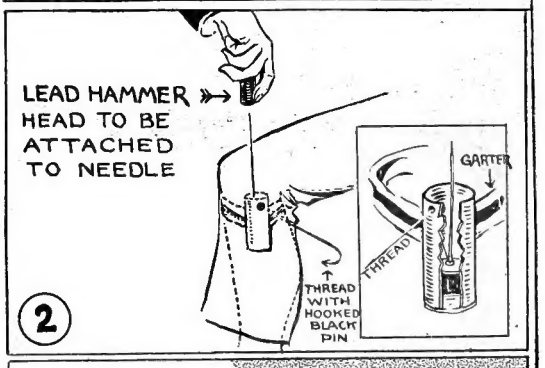
Two accomplices, one on either side of the center of the table, can tip it with uncanny effect by use of the harness here shown which is concealed by the vest.

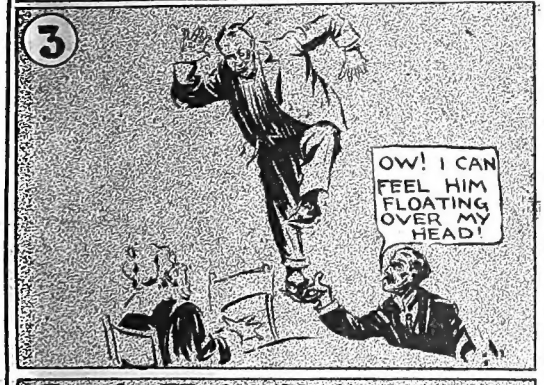




The medium's hands and feet are held, yet strange raps are distinctly heard emanating from the table. The medium may be examined at any moment.

Attached to the garter of the medium's leg is a tube in which a needle slides. To the bottom of this needle a thread is secured terminating at a hook fastened to the other trouser leg. Spreading the legs raises the lead hammer causing a rap.



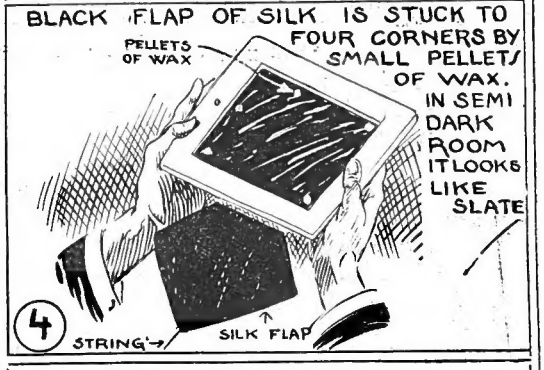


The medium stands on a chair with his toes lightly resting on the hands of two of the sitters in the circle. Under cover of darkness he is believed to be floating around the room.

Under cover of darkness the shoes are slipped off, grasped by the hands and made to move about the room. The spectator is requested to hold on tightly but not to restrain the movement.

A blank slate is signed on both sides by a spectator to prevent substitution. A message mysteriously appears on the slate a short time later. The slate need never leave the spectator's hands.

A message previously written on the slate is covered by a silk flap. This side is presented for signature first. When the slate is turned over, the assistant pulls the silk flap away. The effect is quite astounding.


BLACK FLAP OF SILK IS STUCK TO FOUR CORNERS BY SMALL PELLETS OF WAX. IN SEMI DARK ROOM IT LOOKS LIKE SLATE
PELLETS OF WAX
STRING
SILK FLAP
4

Questions written by audience on folded slips of paper are answered by clairvoyant.

The folded billet is held to the forehead and the contents are revealed. Any slip is lifted and a fake message is given. The billet is then unfolded as if for confirmation, but actually to read the next message. Thus the medium reads one ahead all the time. The last slip of paper is a blank.

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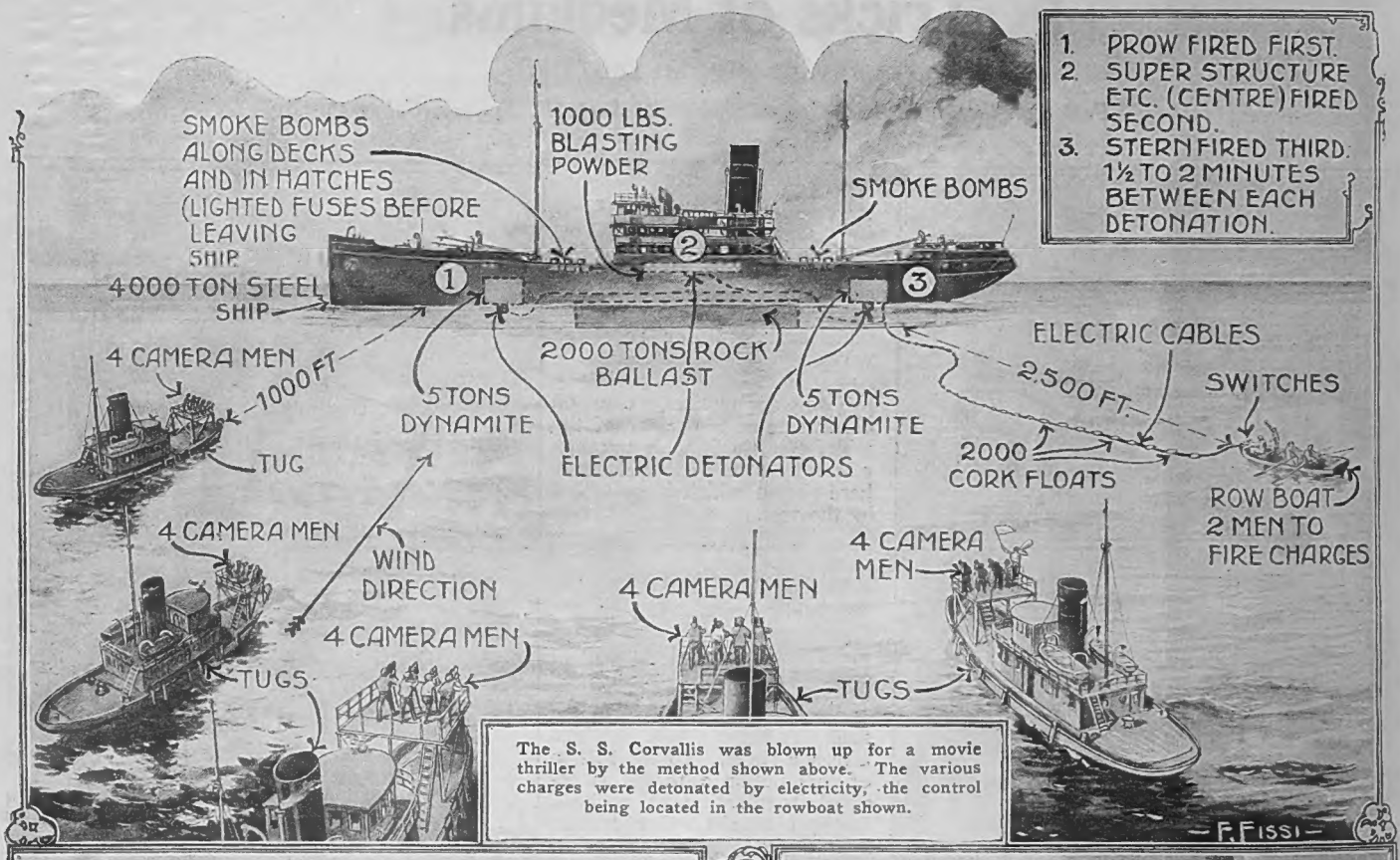
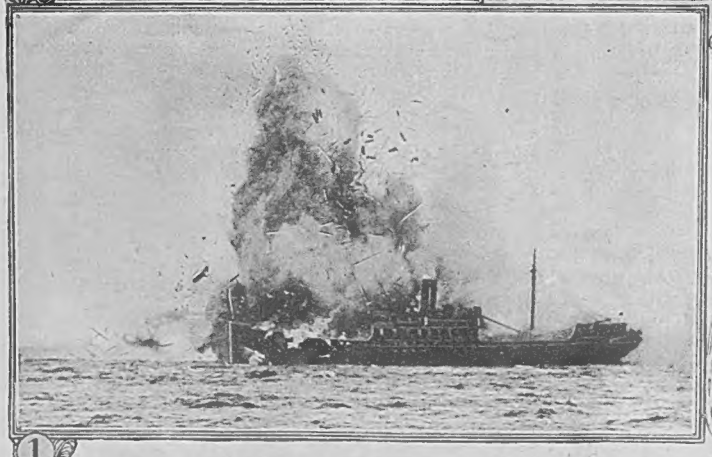
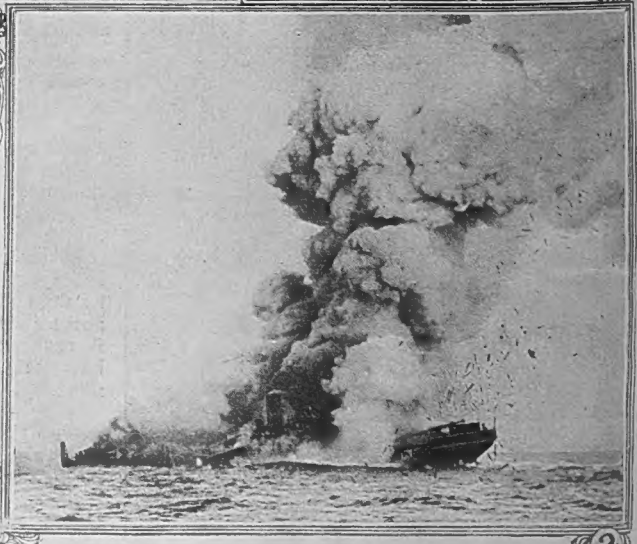


The S. S. Corvallis was blown up for a movie thriller by the method shown above. The various charges were detonated by electricity, the control being located in the rowboat shown.



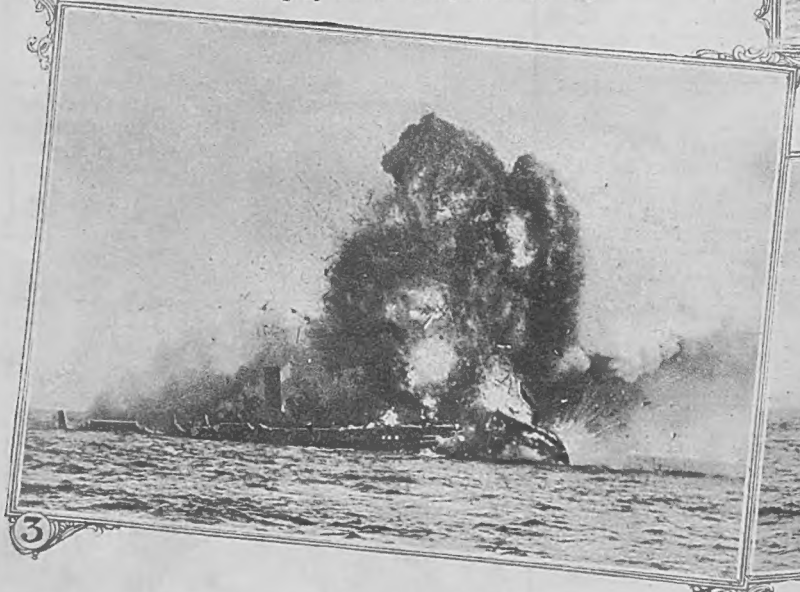
1

Blowing up the forward part of the ship.



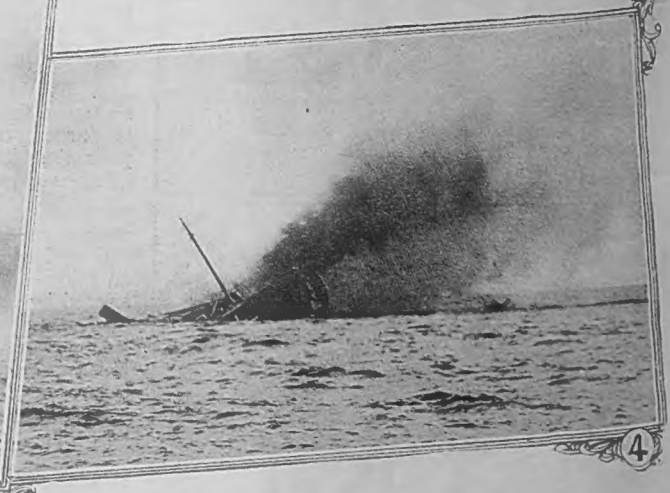
2

The charge in the center has just detonated.



3

The third and last charge of dynamite has just been set off and the stern of the boat blown to pieces. From one and one-half to two minutes elapsed between each two explosions.



4

The smoke of the last explosion has not yet subsided but the remains of the ship are already headed for Davy Jones' locker. The ship was entirely destroyed and sank quite rapidly.

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$900,000 Ship Blown Up for Movie

FOLLOWING the blowing up and sinking of the 4,000-ton steel steamship *Corvallis* in the Atlantic, 100 miles out from Sandy Hook, for a motion picture recently, the sea has once more been made safe and free for shipping in general.

But it took the "persuasion" of a heavily armed government revenue cutter and the temporary detention of the captain, crew and film-producing passengers of the ocean-going tug *Mary Bicknell*, across whose bows a four-pound shot was fired, to accomplish this admirable condition after more than 24 hours of cleaning up and policing of the bounding main.

The *Corvallis*, which was built in 1918 for war service by the United States Shipping Board, was purchased by the movie concern to be used in scenes for "The Half Way Girl," an Earl Hudson production, featuring Doris Kenyon and Lloyd Hughes.

CUTTER OBSERVES EXPLOSION

With five batteries of cameras grinding away on as many tugs the explosion took place under the supervision of the U. S. Coast Guard Cutter *Seneca*, flanked by six rum chasers. Earlier in the day, the *Mary Bicknell*, from which the movie operations were directed, was prepared to blow up the *Corvallis*, renamed the *Mandalay* for the picture, at a point about 75 miles off Sandy Hook.

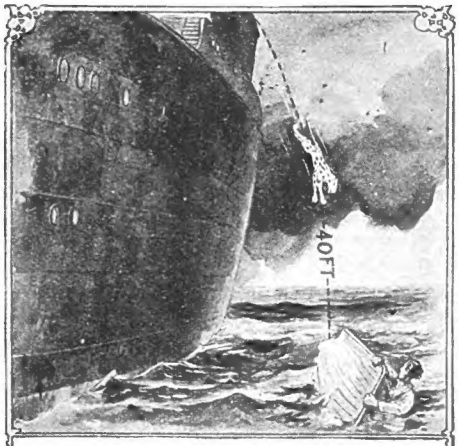
For the purposes of the scenario this part of the sea was supposed to be the Indian Ocean, and at that time no American revenue cutters or rum chasers were supposed to be in the Indian Ocean. Nevertheless the *Seneca*, with her rum-chasing escort, hove into sight, took soundings which revealed the depth of the ocean's floor to be 200 fathoms, and ordered the movie fleet to proceed out 25 miles further where the depth was 300 fathoms, where there would be less danger to navigation from wreckage. The movie fleet moved.

On the *Mary Bicknell* was Tom Persons, the studio manager who supervised the taking of the scenes. With him were Edward P. Morse, Jr., President of the National Drydock Corporation of New York, and three cameramen as well as the crew.

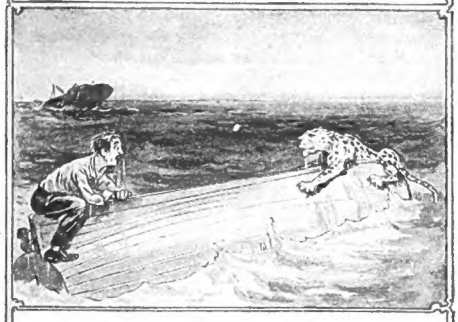
TEN TONS OF DYNAMITE USED

The *Seneca* stood by while the dynamiting took place. Ten tons of dynamite and 1,000 pounds of powder were set off to complete the destruction of the *Mandalay* (or *Corvallis*), which was 284 feet long, with a 28-foot draft. The scene was a brilliant and spectacular success. The great ship heaved as a mass of smoke and flame belched upward with the touching off of the powder, followed in a few seconds by the terrific discharge of the dynamite, and debris was scattered for hundreds of yards around the ocean.

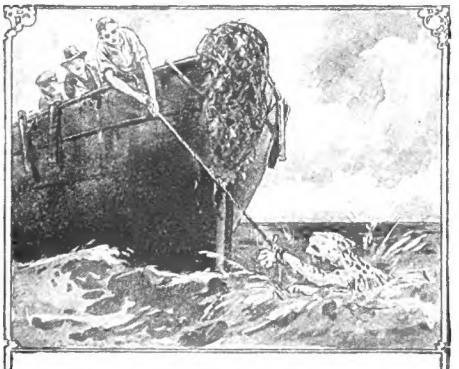
The drawing and photos on the opposite page show in detail just how this mastodonic movie shipwreck was handled. As will be seen ten tons of dynamite were placed inside the steamship fore and aft. 1,000 lbs. of blasting powder was placed amidship and 2000 tons of rock ballast was loaded into the bottom of the ship. The blasting powder and dynamite charges were fired on a signal from the director, who was aboard one of the tugs carrying some of the motion picture cameras. The firing signal was picked up by the two men designated for the task who were aboard the rowboat shown in the picture. At the first signal the five tons of dynamite in the forward part of the ship was detonated. At the second signal a few minutes later the 1000 lbs. of blasting powder in the ships superstructure was fired. This was followed three minutes later by the third and final explosion of the five tons of dynamite in the rear part of the hull. It should be mentioned that the smoke bombs placed along the deck of the ship had their fuses lighted before the crew left the vessel.



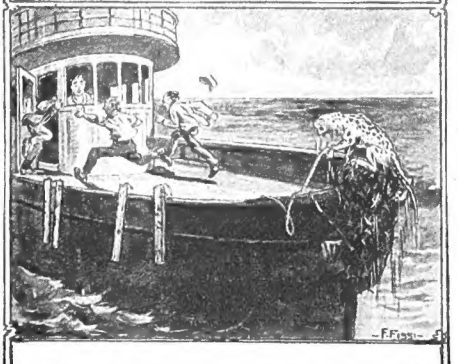
Leopard, used in photoplay, diving forty feet into ocean. Leopards can swim.



The hero receives a surprise caller in the form of a real live leopard.



The leopard put one paw through a rope noose thrown him.



When Mr. Leopard reached the deck, the crew disappeared like magic.

The electric cables used in detonating the charge on board the ship were supported on the surface of the ocean by 2000 cork floats, each measuring about six inches in diameter. There were three electric cables used.

After the explosion the captain of the *Seneca* ordered the *Mary Bicknell* to stand by to pick up any wreckage that might come to the surface and imperil navigation. Then the *Seneca* moved on, leaving the tug at the business of straightening out the mess. But the sea was heavy and no place for land-lubbers, and it wasn't long before those aboard the *Mary Bicknell* figured that what bits of flotsam and jetsam and rubbish remained afloat would do no harm. They longed for the steadiness of shore, for trees and flowers and pavements. A short time later the *Seneca* returned to the scene of the explosion to see what sort of a job had been done. The *Mary Bicknell* was gone, and it was found that one of the masts of the *Corvallis* hadn't sunk deep enough to make passage of other vessels in that region safe.

SHOT HALTS TUG

The *Seneca* started in pursuit and about 25 miles away overhauled the *Mary Bicknell;* she apparently didn't understand the order even after it was repeated several times. The *Seneca* fired a four-pound shot across the bow of the *Mary Bicknell.* The latter, sensing that all was not as it should be, stopped. The captain of the *Seneca* thought it would be a good idea for the *Mary Bicknell* to return to the scene of the brilliant marine "disaster" and, boarding the tug, said so. The captain of the *Mary Bicknell,* with a sidelong glance at the *Seneca's* four-pounder, also thought it would be a good idea.

The cost of the spectacular scenes in which the *Corvallis,* built during the war at an approximate expenditure of $900,000, is estimated by the producer, Earl Hudson, at $125,000.

LEOPARD PLAYS EXCITING ROLE

A trained leopard played an exciting rôle during the filming of this ship-wreck scene.

After filming the leopard on board the steamship in several different locations, he was supposed to jump forty feet into the ocean from the superstructure, and this he did very gracefully. The hero was awash and clinging to the rowboat. It was figured that the leopard could be lassoed or enticed to grip a rope and hauled on board one of the tugs. Instead he swam to the overturned rowboat and climbed up on one end of it and started crawling along the keel, much to the astonishment of the actor hanging on to the other end of the keel. The actor dived off the boat and started swimming away and the leopard fell into the water. Then one of the men on a tug threw a rope to the animal. He put one paw through the loop on the end of the rope, just like a man, and he was hauled part way out of the water when he managed to get his claws into the rope bumper on the front of the tug. The big cat came up over the rope bumper quicker than expected, and it was amusing to see the crew clear the deck and almost trample one another in their haste to get into the cabins and shut the doors, which slammed too with a simultaneous and emphatic bang.

The animal trainer who was on board the tug put the crew to shame as he sensed that all was the matter with Mr. Leopard was that he was cold and wet and this proved to be the case. The trainer got blankets and soon had the animal warm and comfortable.

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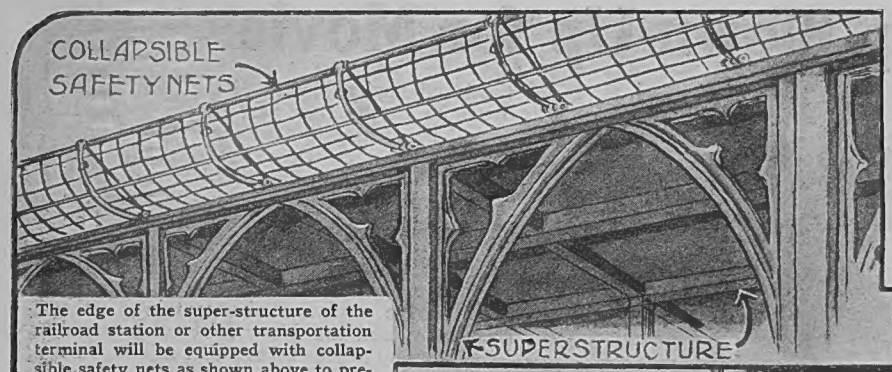
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

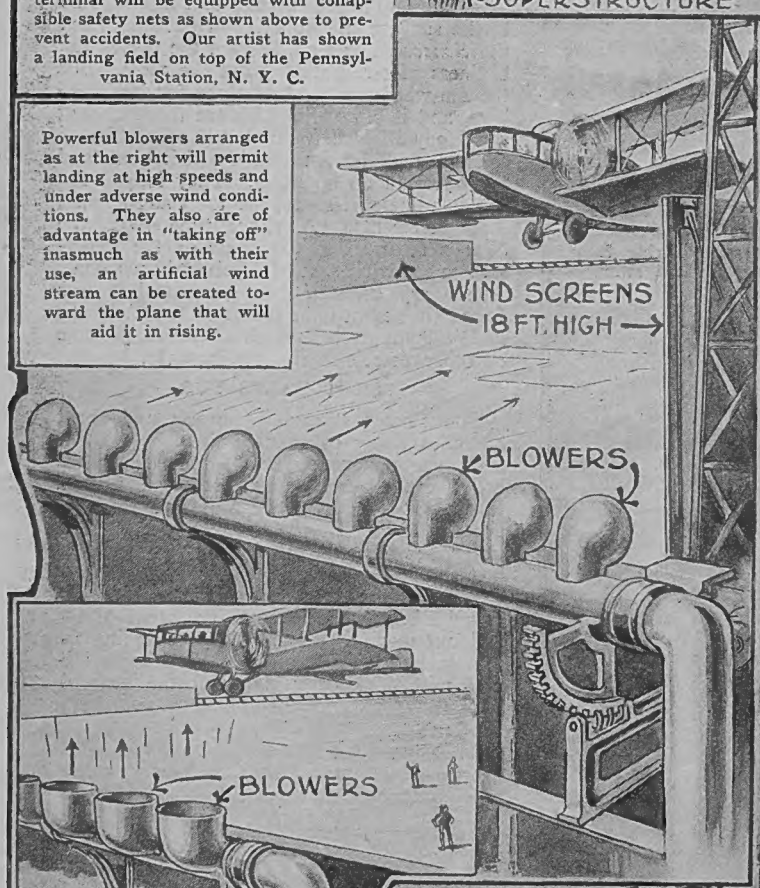
Novel Airport Atop

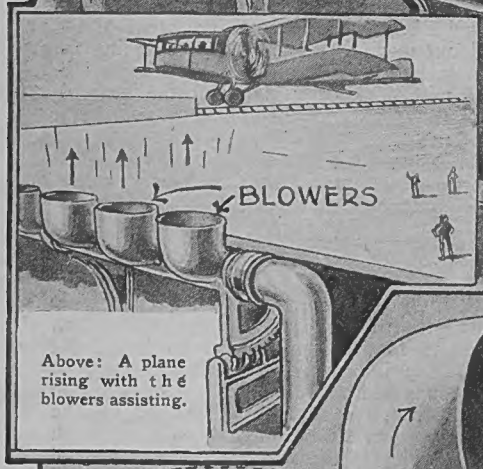
The Transoceanic and Transcontinental Air Swing in the Near Future forms Atop Other



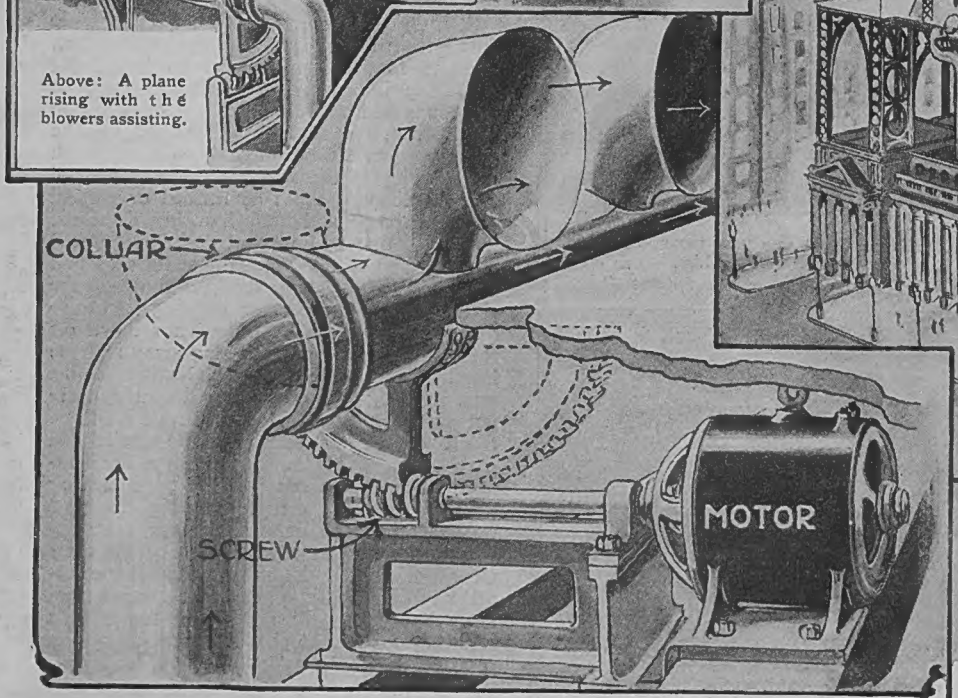
The edge of the super-structure of the railroad station or other transportation terminal will be equipped with collapsible safety nets as shown above to prevent accidents. Our artist has shown a landing field on top of the Pennsylvania Station, N. Y. C.

Powerful blowers arranged as at the right will permit landing at high speeds and under adverse wind conditions. They also are of advantage in "taking off" inasmuch as with their use, an artificial wind stream can be created toward the plane that will aid it in rising.

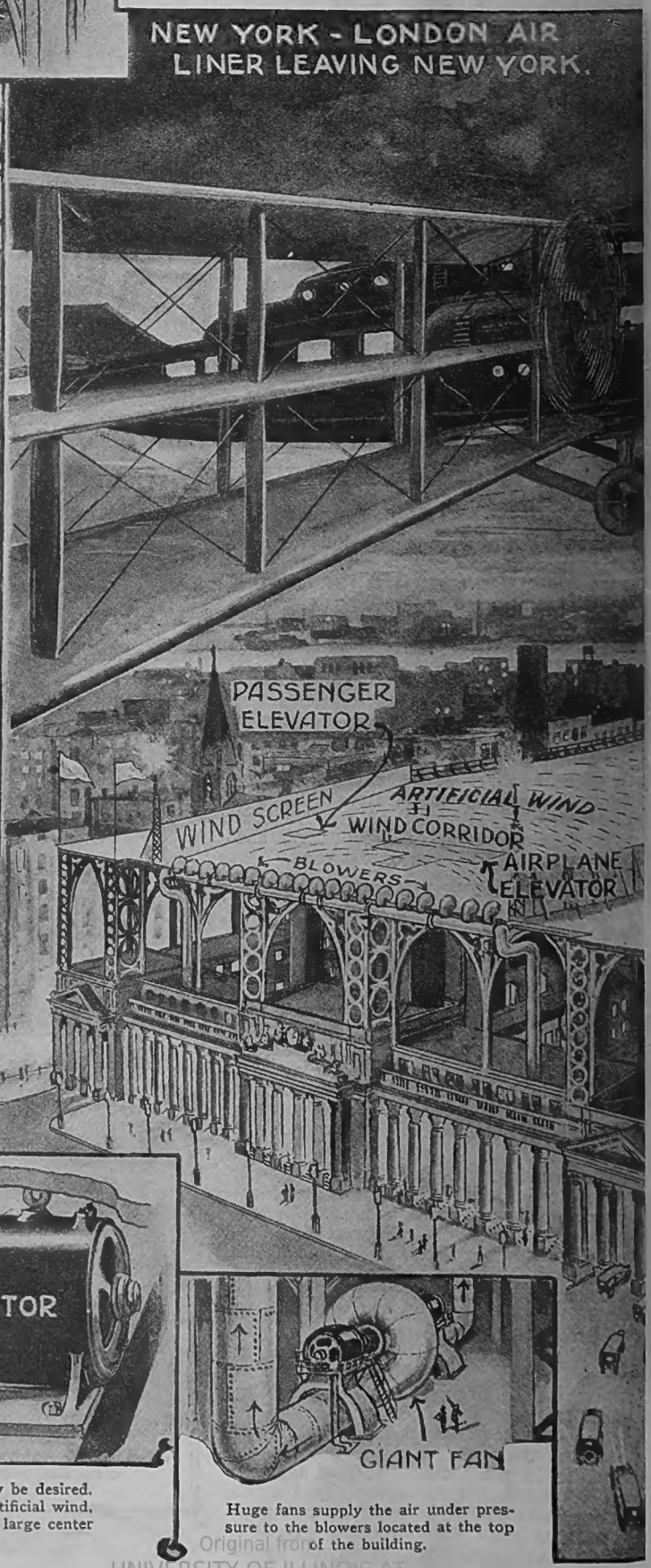




Above: A plane rising with the blowers assisting.



Above: The mechanism that operates the blowers so that they can be tilted as may be desired. In connection with these blowers, wind screens are used so as to concentrate the artificial wind, and so as to prevent side winds from affecting the landing. These are shown in the large center illustration on this page.



Huge fans supply the air under pressure to the blowers located at the top of the building.

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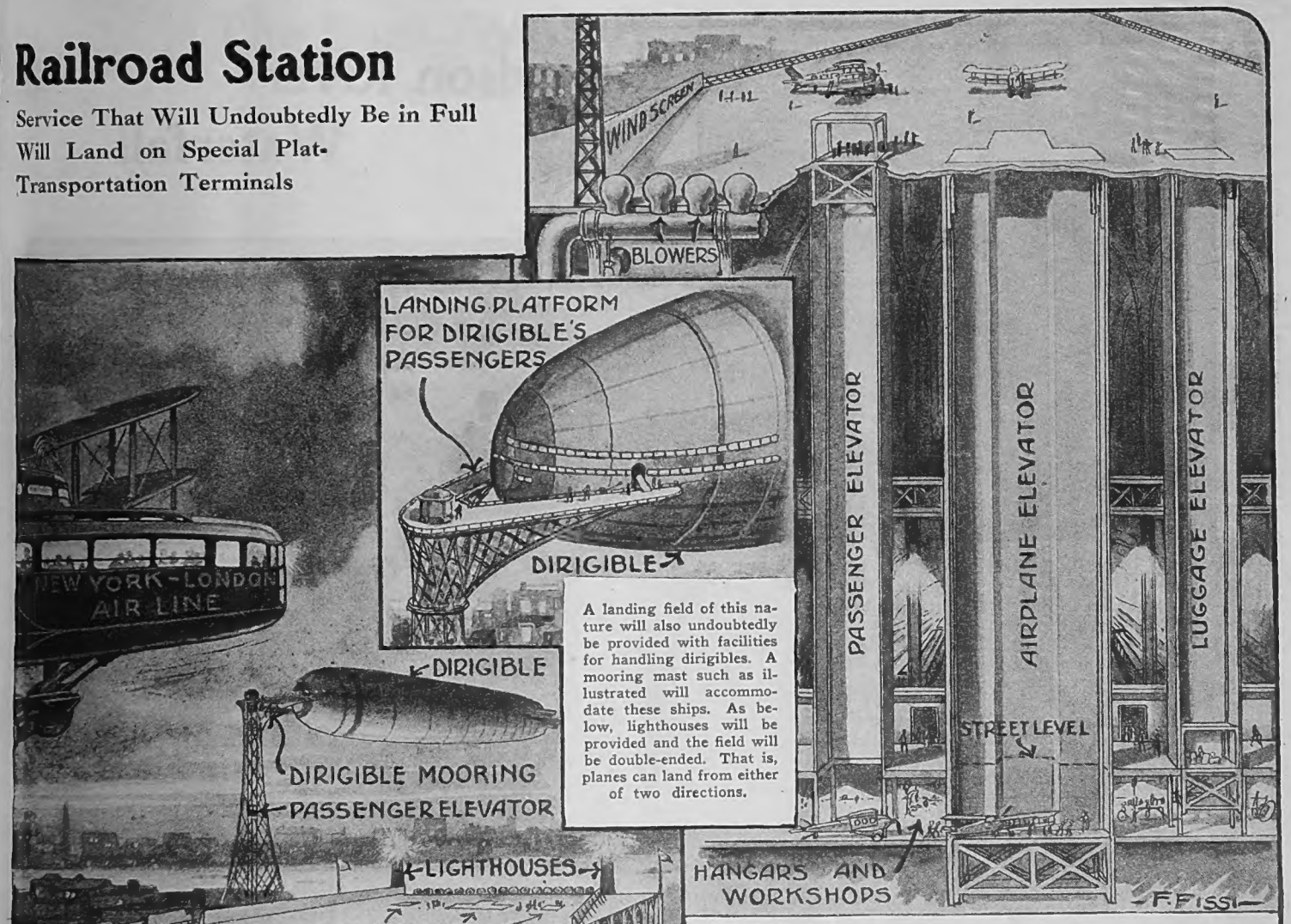
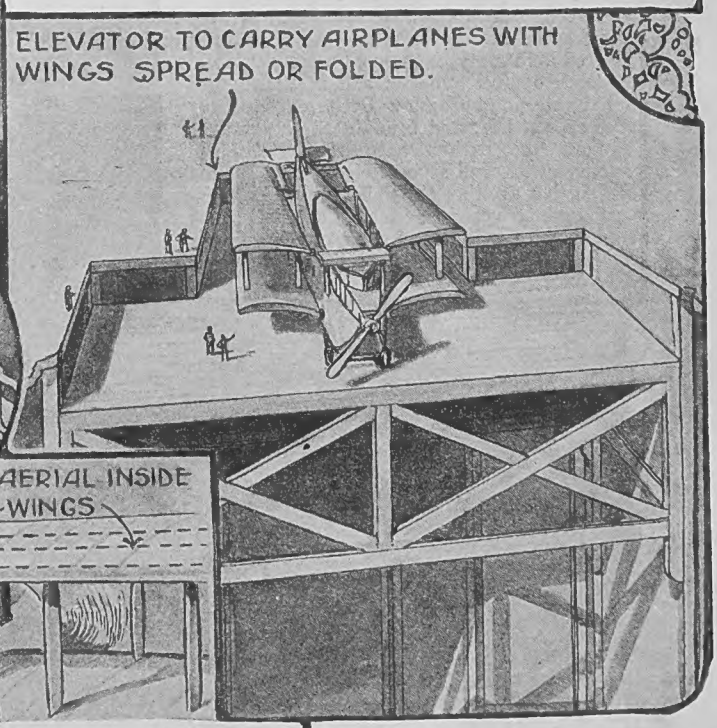
Railroad Station

Service That Will Undoubtedly Be in Full Will Land on Special Plat- Transportation Terminals

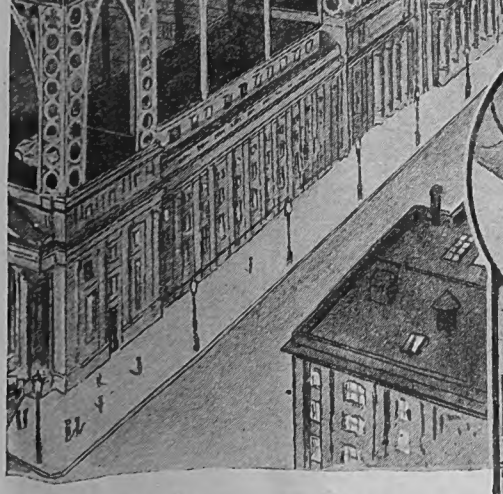


A landing field of this nature will also undoubtedly be provided with facilities for handling dirigibles. A mooring mast such as illustrated will accommodate these ships. As below, lighthouses will be provided and the field will be double-ended. That is, planes can land from either of two directions.

Specially built elevators will provide access to the landing stage. One of them, designed as shown above and below, will be so arranged as to carry airplanes with wings either spread or folded. Workshops and hangars will be in the basement.



The illustration above shows the form which an elevator for carrying airplanes will probably take. Because of its peculiar shape, it can carry a plane with its wings folded or extended.



Situated directly above a railroad terminal or other transportation base, a landing field of this nature will be of infinite value in extending the use of air transportation. Passengers and freight can be quickly transferred from the air to railroads and can be carried to their destinations with the least possible inconvenience.

The pilot of an airplane coming into a landing field of this nature will be informed by radio by the man at the blower control as to which way to enter.

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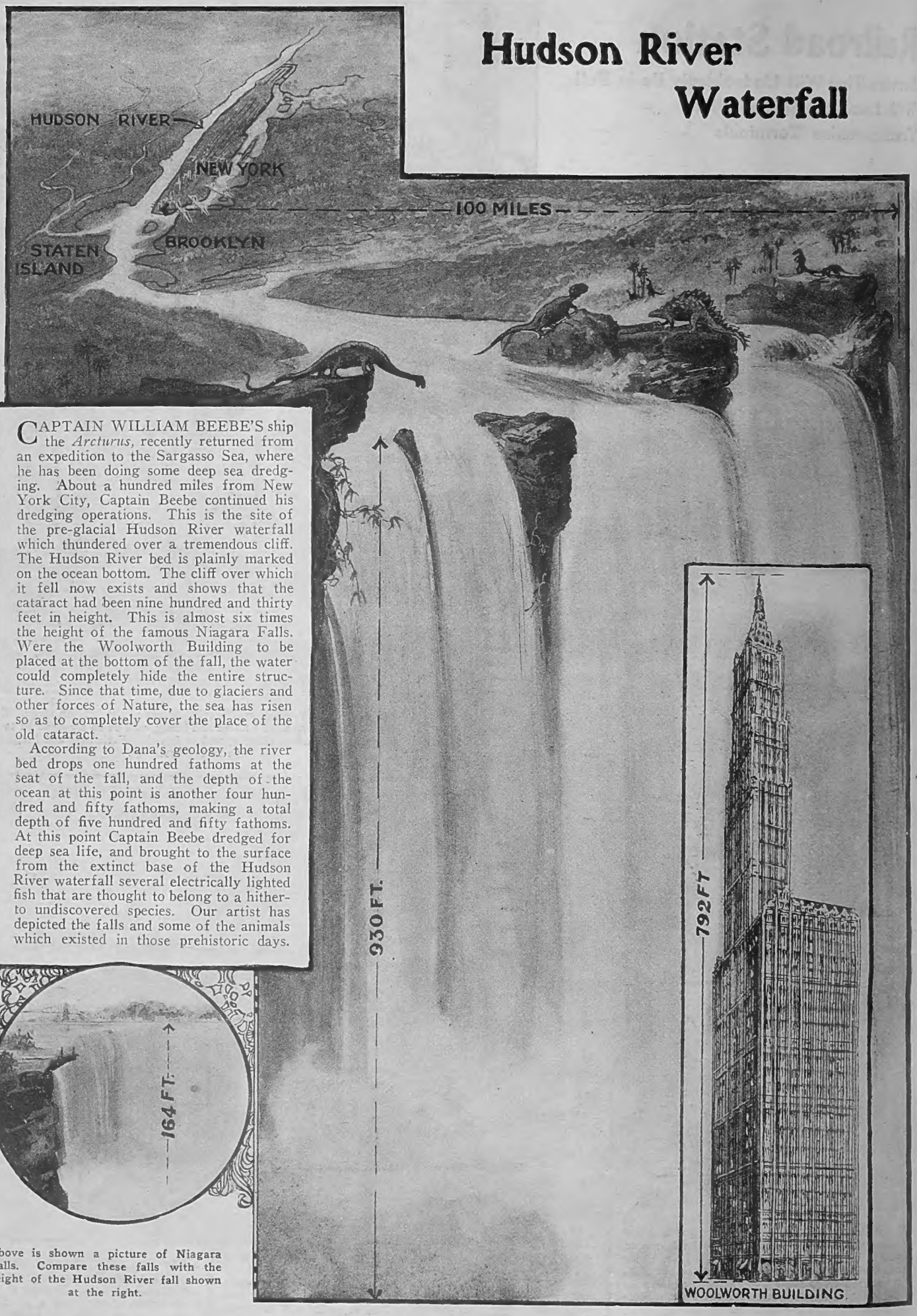
Hudson River Waterfall



CAPTAIN WILLIAM BEEBE'S ship the *Arcturus*, recently returned from an expedition to the Sargasso Sea, where he has been doing some deep sea dredging. About a hundred miles from New York City, Captain Beebe continued his dredging operations. This is the site of the pre-glacial Hudson River waterfall which thundered over a tremendous cliff. The Hudson River bed is plainly marked on the ocean bottom. The cliff over which it fell now exists and shows that the cataract had been nine hundred and thirty feet in height. This is almost six times the height of the famous Niagara Falls. Were the Woolworth Building to be placed at the bottom of the fall, the water could completely hide the entire structure. Since that time, due to glaciers and other forces of Nature, the sea has risen so as to completely cover the place of the old cataract.

According to Dana's geology, the river bed drops one hundred fathoms at the seat of the fall, and the depth of the ocean at this point is another four hundred and fifty fathoms, making a total depth of five hundred and fifty fathoms. At this point Captain Beebe dredged for deep sea life, and brought to the surface from the extinct base of the Hudson River waterfall several electrically lighted fish that are thought to belong to a hitherto undiscovered species. Our artist has depicted the falls and some of the animals which existed in those prehistoric days.

Above is shown a picture of Niagara Falls. Compare these falls with the height of the Hudson River fall shown at the right.

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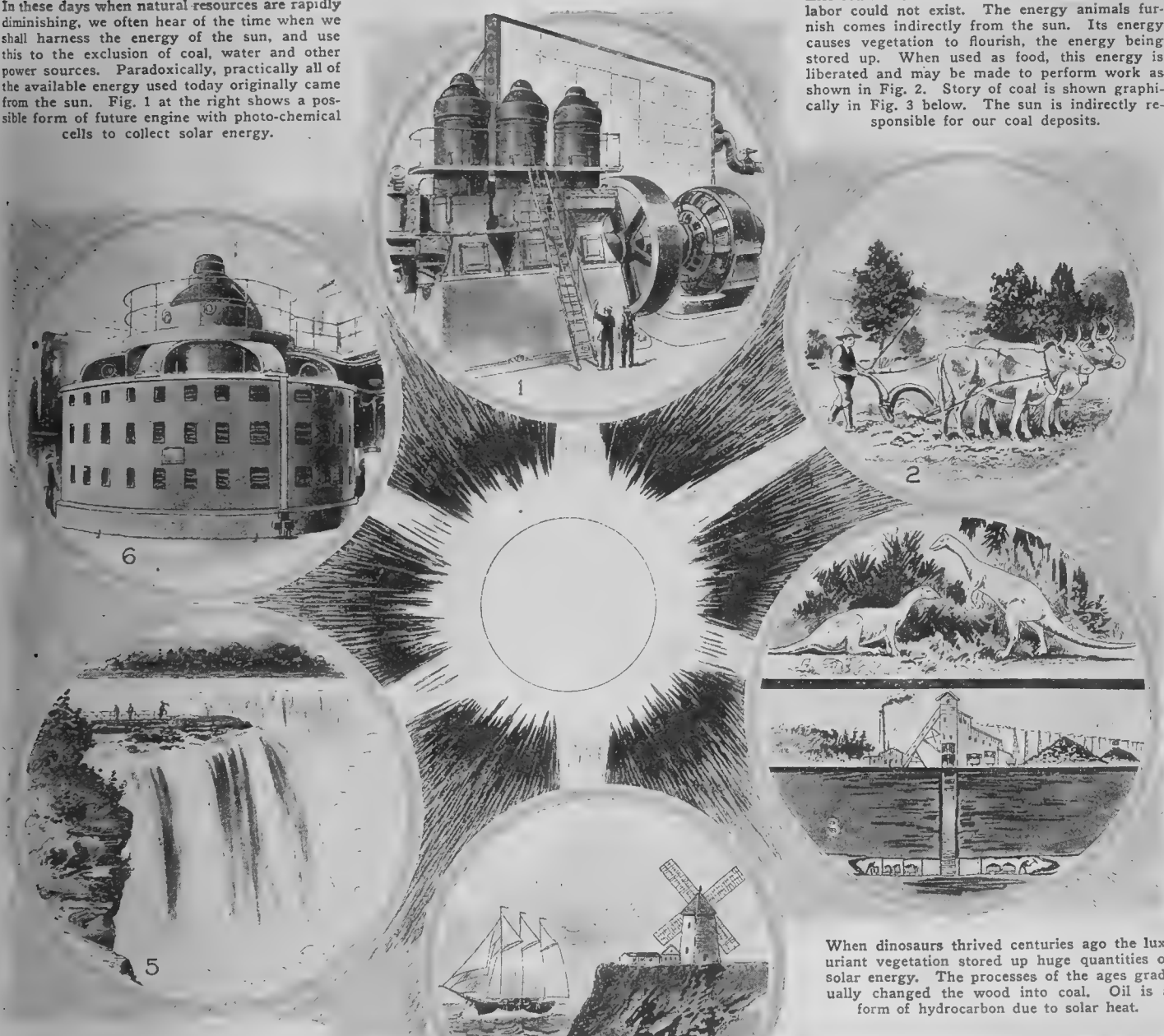
The Sun—World's Greatest Engine

By Professor Donald H. Menzel, Ph.D.

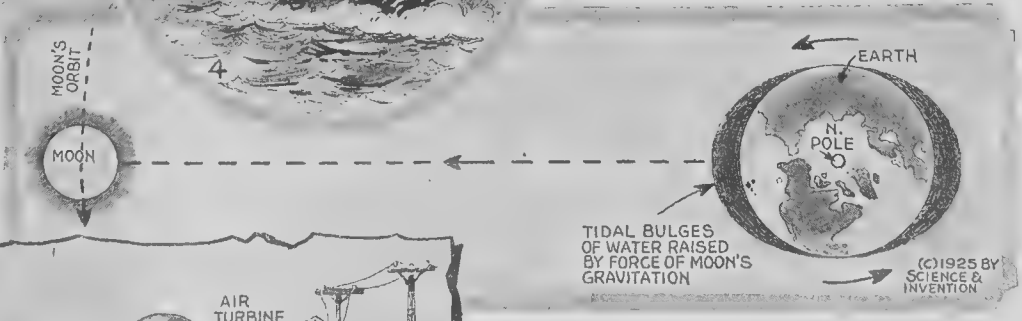
In these days when natural resources are rapidly diminishing, we often hear of the time when we shall harness the energy of the sun, and use this to the exclusion of coal, water and other power sources. Paradoxically, practically all of the available energy used today originally came from the sun. Fig. 1 at the right shows a possible form of future engine with photo-chemical cells to collect solar energy.

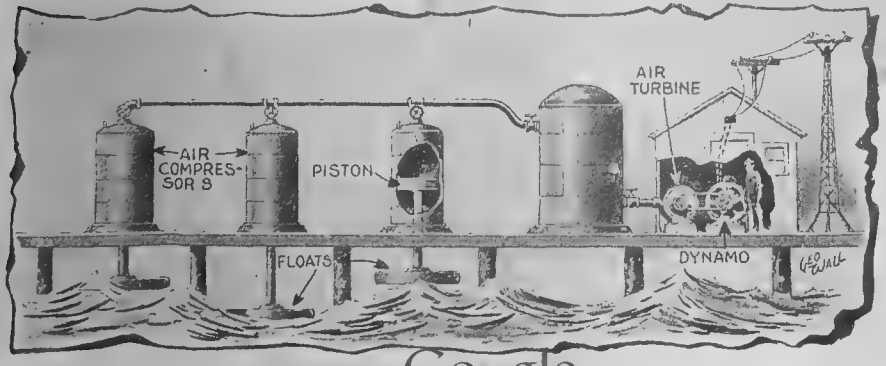
Life could not exist without the sun—even animal labor could not exist. The energy animals furnish comes indirectly from the sun. Its energy causes vegetation to flourish, the energy being stored up. When used as food, this energy is liberated and may be made to perform work as shown in Fig. 2. Story of coal is shown graphically in Fig. 3 below. The sun is indirectly responsible for our coal deposits.



When dinosaurs thrived centuries ago the luxuriant vegetation stored up huge quantities of solar energy. The processes of the ages gradually changed the wood into coal. Oil is a form of hydrocarbon due to solar heat.

Fig. 4 shows sailing vessel and windmill. Without the sun there would be no wind. The layer near the ground is warmed by the sun's heat and, in expanding, becomes lighter than the cooler layers immediately above. The denser air, in sinking to take the place of a warmer gas, causes the air currents known as wind.





Electric current, developed from water power (Fig. 5) represents solar energy in another dress. The sun evaporated the water, air currents distributed it, and it fell as rain. Fig. 6 shows huge dynamo driven by steam; steam owes its origin to the sun. The greatest source of undeveloped energy is doubtless tidal power. The diagram above shows how moon raises bulges of water on opposite sides of the earth, which by rotating keeps these waters moving over the surface, and therefore, furnishes enormous quantities of potential energy.

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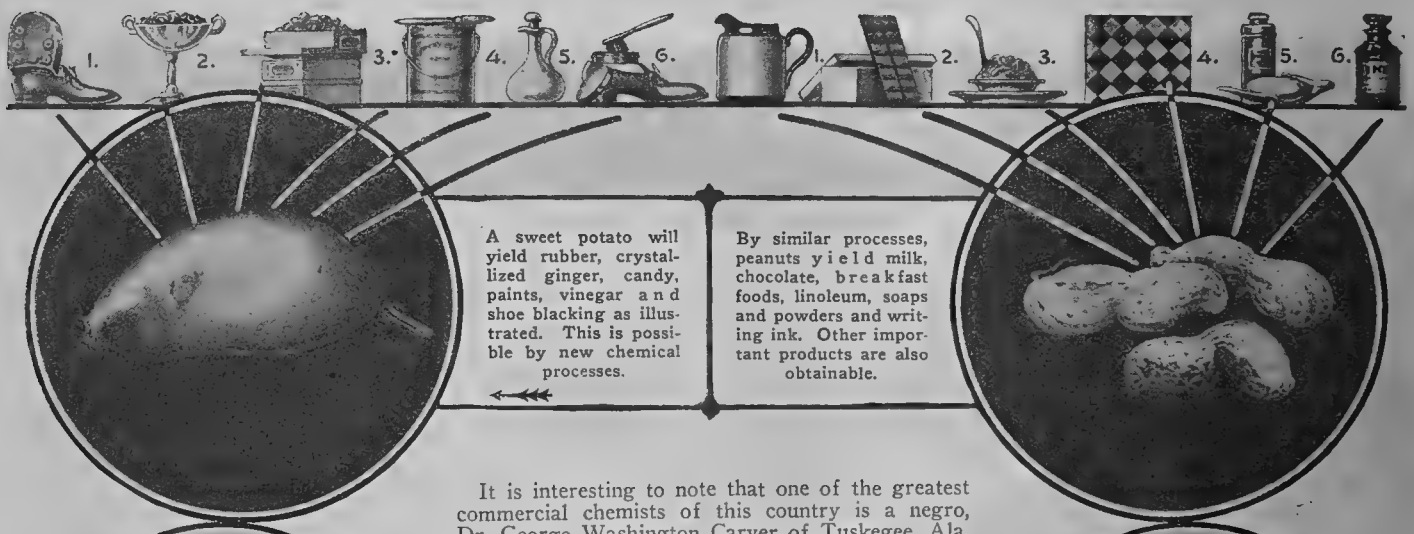
The Work of a Negro Chemist



A sweet potato will yield rubber, crystallized ginger, candy, paints, vinegar and shoe blacking as illustrated. This is possible by new chemical processes.

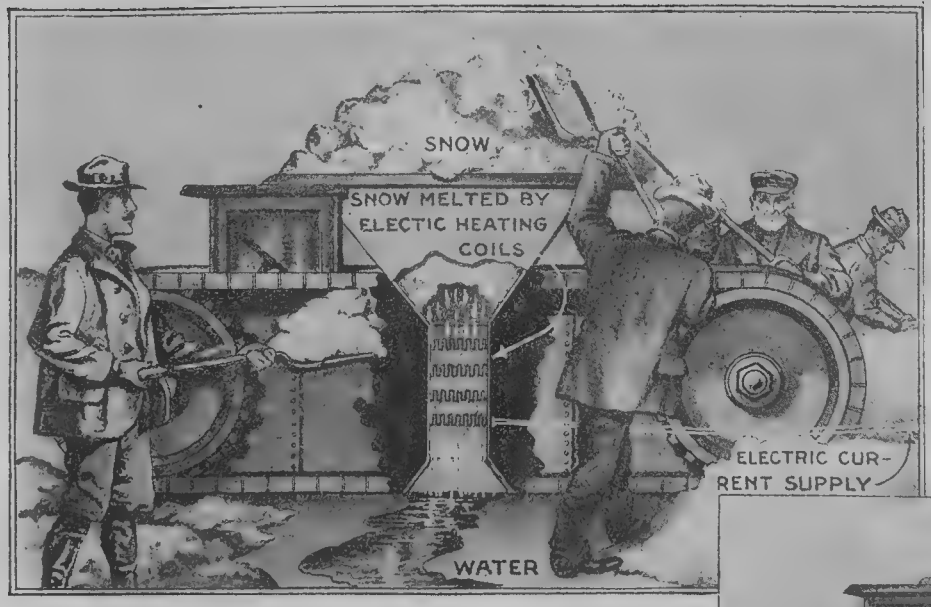
By similar processes, peanuts yield milk, chocolate, breakfast foods, linoleum, soaps and powders and writing ink. Other important products are also obtainable.

Pecan nuts when properly treated will yield over sixty commercial products.

It is interesting to note that one of the greatest commercial chemists of this country is a negro, Dr. George Washington Carver of Tuskegee, Ala. Struggling against the odds that beset his race, he has risen to a prominent place in the commercial world. In his experimental laboratory at Agricultural Hall, in the Tuskegee Institute, he has developed many items which will be of benefit to the world at large. From products of the country he has extracted hundreds of well known foods, paints and other articles of great utility. Some of these are illustrated on this page. The soil and products of the soil have contributed to his success. His most notable exploits have been in the extraction of various utilities from such products as the sweet potato, peanut, pecan and the soil itself. Dr. Carver claims that his discoveries are due to divine inspiration and states that he has never even used a book in his laboratory.

Several hundred different dyes have been developed from earth clays.

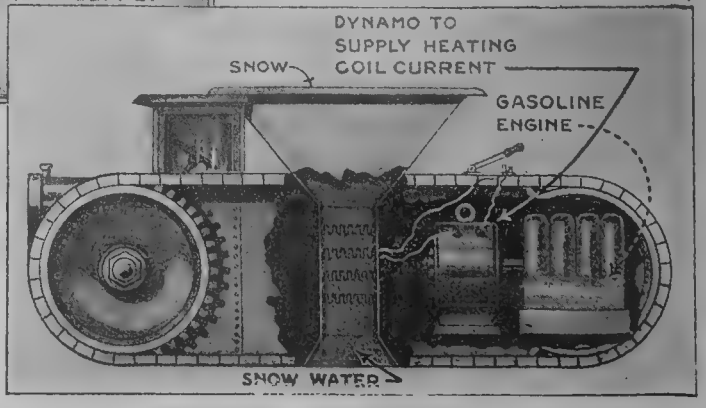
Electrical Snow Remover



The snow-melting and removing device illustrated above makes use of coils heated by electricity which is supplied from the city mains to melt the snow.

A new type of portable snow remover operated by electricity is illustrated at the left. This device has been tested in a large city during a heavy snow storm and has been found to be quite satisfactory in operation. The snow-melting device is mounted upon a tractor equipped with caterpillar treads so as to render its transportation from one point to another easy. This unit may either have a self-contained engine for transportation or may be towed to its operating position by an ordinary tractor. When in place, the snow is shoveled into the top as shown, whereupon the material is fed through a funnel-shaped opening past heating coils. The heat from these coils melts the snow and the resulting water runs out the bottom and into the sewer system. The current is obtained from the city mains.

The illustration below shows a completely self-contained snow remover. A generator supplies the heating coil current.



A completely self-contained snow-removing unit has been suggested and is illustrated in detail at the right. A gasoline engine is used for a dual purpose. It may be used either to drive the device to its operating location or when the device is in position, it may serve to drive a generator which supplies the current for the heating coils which melt the snow. The device is always placed, when in use, near an opening to the city sewers.

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Gigantic Iceberg Sighted

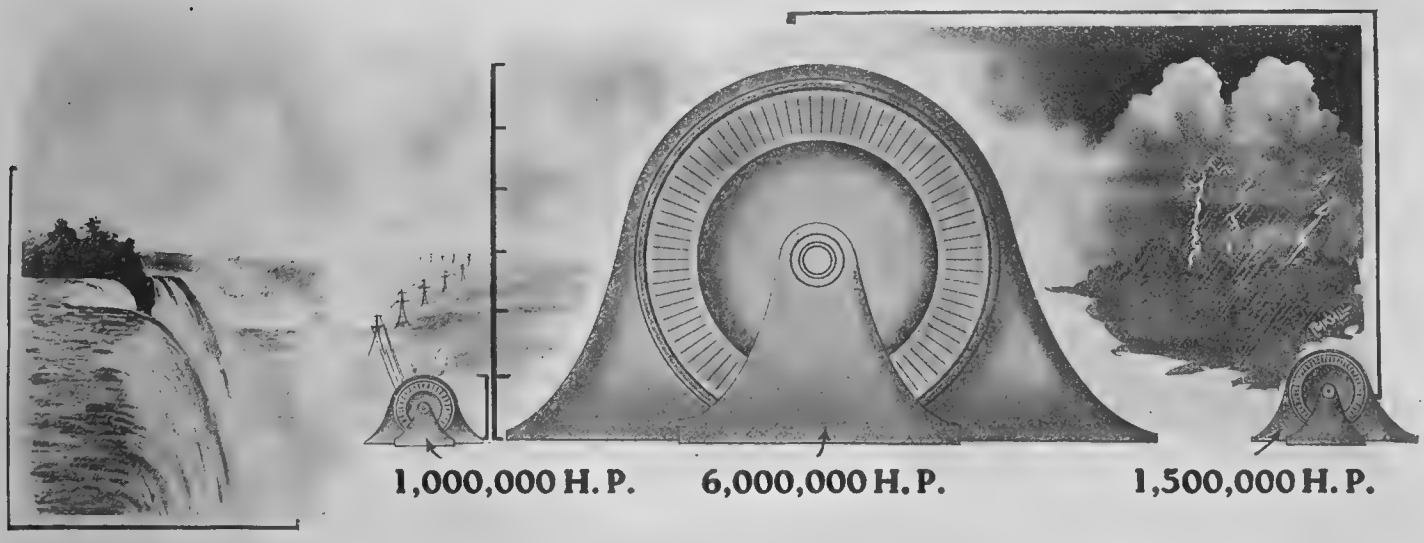
By H. WINFIELD SECOR

WOOLWORTH BUILDING
792 FT HIGH
250 FT
1000 FT
800 FT
PROBABLE DEPTH BELOW WATER 1500 FT
AVERAGE OCEAN GOING SHIP 400 FT LONG
6/7 OF ICEBERG BELOW WATER
NEW YORK
U.S.A.
ENOUGH ICE IN ICEBERG TO FURNISH SUMMER'S ICE SUPPLY FOR WHOLE UNITED STATES
1/2 MILE
CENTRAL PARK-N.Y.C.
2½ MILES
ENOUGH ICE TO MAKE PILE ON CENTRAL PARK 23 FT HIGH
23 FT HIGH

Passengers on board the Scandinavian-American liner, Oscar II, recently were treated to a sight that ocean travelers may not see again for many a year. An iceberg whose size was estimated to be 1,000 feet long by 800 feet wide with a peak towering to 250 feet was seen. An iceberg of this size probably extends at least 1,500 feet below the waterline, and the area covered at the waterline is more than 18 acres. Officers of the liner say that the berg is the largest that they have ever seen in the Atlantic Ocean. At the time, the approach to the iceberg was protected by a United States Coast Guard vessel in order to prevent accidents.

The ice in a berg of this size would be sufficient to furnish the entire summer's ice supply to the United States. If it were incorporated in a block the size of Central Park, N. Y. City, as at the right, such a block would be 23 feet in height.

Nature, Producer of Electricity

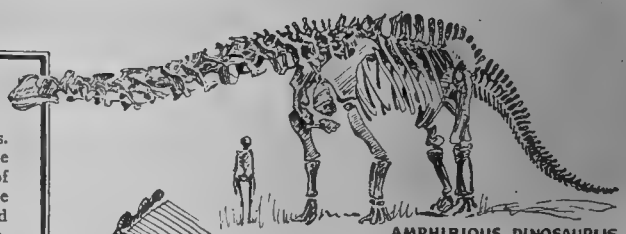


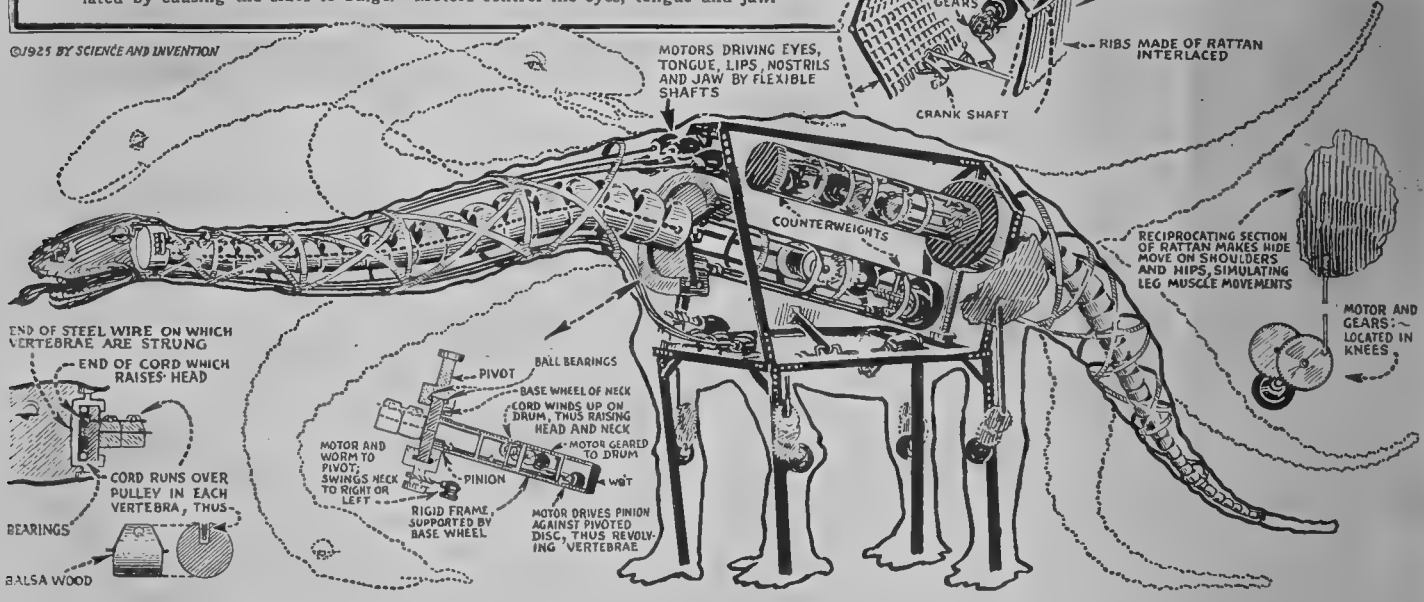
AT some point on the surface of the earth there is always an electrical storm in action. F. W. Peek, Jr., engineer of the General Electric Co., recently made a statement regarding the quantity of power produced by these storms. Comparing it with one great source of electrical power that we have under our control today, namely Niagara Falls, we find that the power produced by these storms at any one instant is greater than the output of the above mentioned generating station. Niagara Falls develops one million horsepower as at the left above, whereas it could develop six million as in the center, if all of the available energy were harnessed. Usually there are an average of 1800 lightning storms in progress, giving 300,000 flashes per hour and developing 1,500,000 horsepower. These figures are based on investigations recently conducted by a large electrical concern in the preparation and production of artificial lightning for experimental purposes and study.

Google

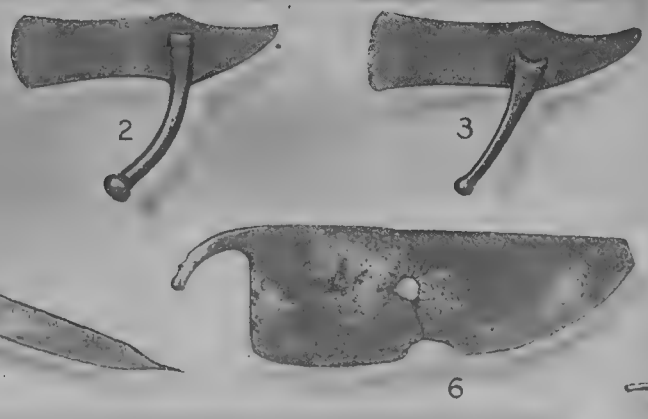
Lifelike Dinosaur

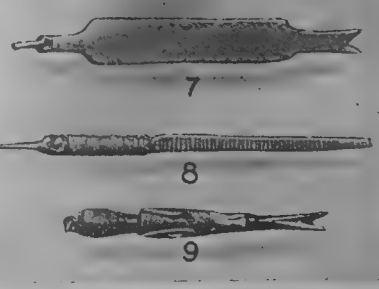
The dinosaurus, a gigantic lizard-like animal lived on this earth millions of years ago. Its approximate weight was 40,000 pounds. Strange as it may seem, Messmore and Damon have reconstructed this animal and endowed it with lifelike movements. The ingenious mechanisms for doing this are shown on this page. To the right we see the skeleton of this Dinosaurus as it appears mounted in the American Museum of Natural History, and above is the reconstructed fifty-foot monster. The body of the reconstruction contains the motors which cause the tail to swish back and forth and the head to move up and down. The neck and tail sections are made of artificial vertebrae of balsa wood. These are threaded upon a cord and cut V-shaped at the top. Another cord running over pulleys is tightened to cause the neck to raise. By turning the neck slightly, the head moves in all directions. Breathing movements are simulated by causing the sides to bulge. Motors control the eyes, tongue and jaw.




©1925 BY SCIENCE AND INVENTION
HINGED
MOTOR GEARS
BREATHING MOTION
RIBS MADE OF RATTAN INTERLACED
CRANK SHAFT
MOTORS DRIVING EYES, TONGUE, LIPS, NOSTRILS AND JAW BY FLEXIBLE SHAFTS
COUNTERWEIGHTS
RECIPROCATING SECTION OF RATTAN MAKES HIDE MOVE ON SHOULDERS AND HIPS, SIMULATING LEG MUSCLE MOVEMENTS
MOTOR AND GEARS: LOCATED IN KNEES
END OF STEEL WIRE ON WHICH VERTEBRAE ARE STRUNG
END OF CORD WHICH RAISES HEAD
CORD RUNS OVER PULLEY IN EACH VERTEBRA, THUS
BEARINGS
BALSA WOOD
PIVOT
BALL BEARINGS
BASE WHEEL OF NECK
CORD WINDS UP ON DRUM, THUS RAISING HEAD AND NECK
MOTOR AND WORM TO PIVOT; SWINGS NECK TO RIGHT OR LEFT
MOTOR GEARED TO DRUM
PINION
WEIGHT
RIGID FRAME, SUPPORTED BY BASE WHEEL
MOTOR DRIVES PINION AGAINST PIVOTED DISC, THUS REVOLVING VERTEBRAE

How The Romans Shaved





The problem of how the Romans shaved has occupied a good deal of attention for many years. Everyone is of course aware of the fact that the Romans did shave, and they had a number of distinctive styles of beard trimming and hair cutting. Others were smooth shaven as illustrated at 1, in the photo of the bust of Julius Caesar. Illustration 2 shows an Egyptian bronze razor, the handle of which indicates that these razors were pulled, not pressed, down the face. Illustration 3 shows another type of the same razor. In illustration 5 the razor seems curiously modern in appearance. This is an Egyptian razor discovered by the late Lord Carnarvon. Illustration 6 shows a short handle Roman iron razor found in France, and 7, 8, and 9 are nail files used by the early Roman dandies. The Romans were incidentally not without their mirrors. The photograph at 4 shows a shaving mirror more than 2,000 years old, made of highly polished metal.

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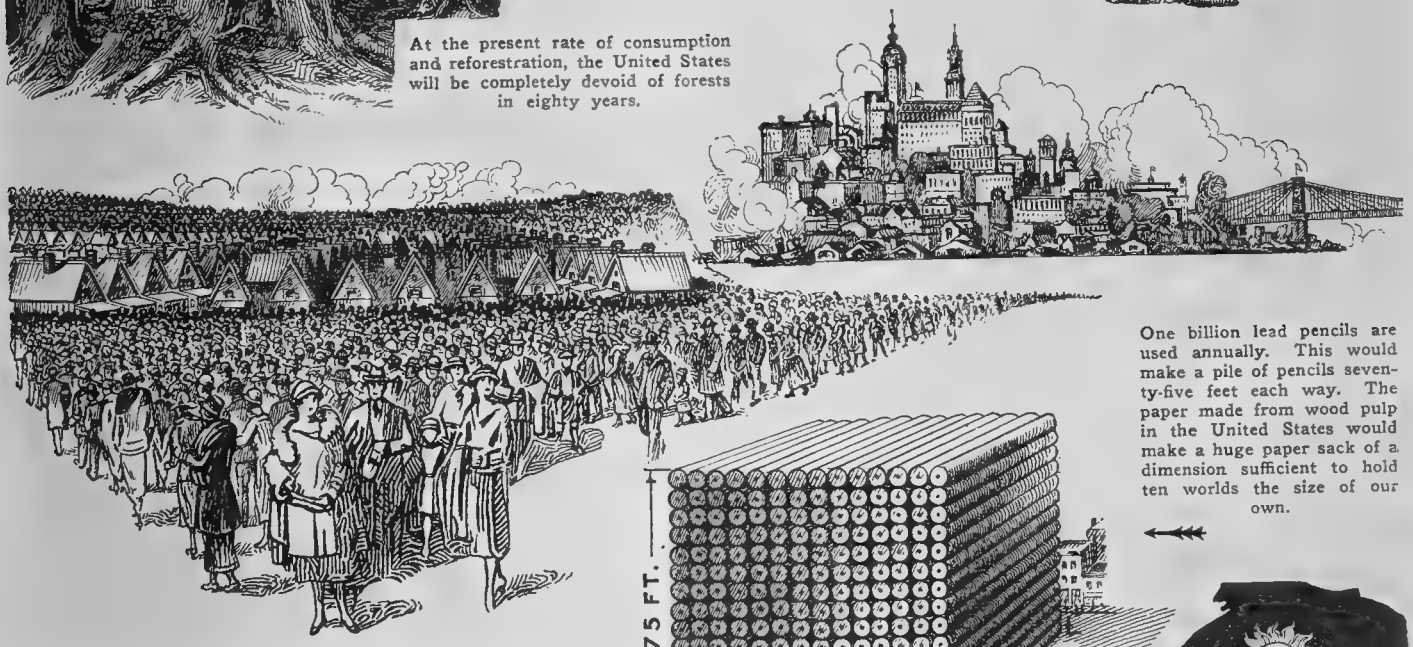
Our Wood Supply

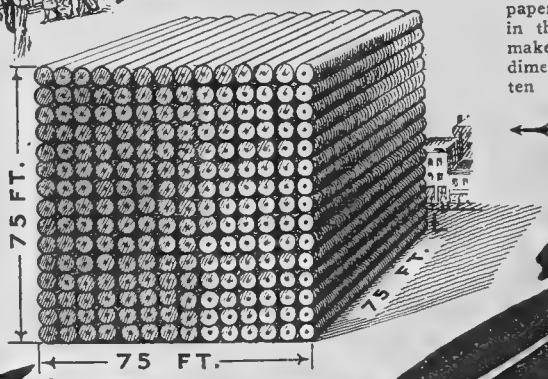
By SAM BROWN

At the present rate of consumption and reforestration, the United States will be completely devoid of forests in eighty years.

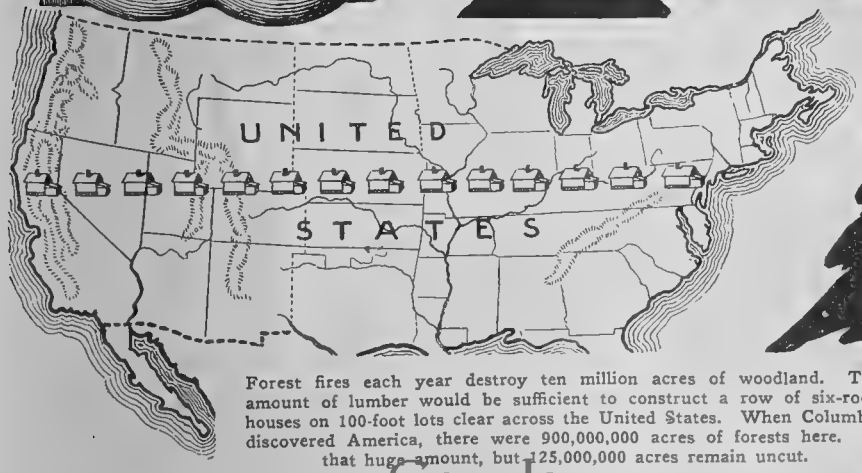


The people in the United States annually use twenty-five billion cubic feet of lumber, enough to make one half a million ordinary six-room houses. These houses could completely rehouse the population of New York City.

One billion lead pencils are used annually. This would make a pile of pencils seventy-five feet each way. The paper made from wood pulp in the United States would make a huge paper sack of a dimension sufficient to hold ten worlds the size of our own.



Annual use of news print and magazine paper alone in the United States would form a walk three feet wide stretching to the sun. Every year we use six million telegraph and telephone poles, enough to carry a wire around the world twelve times. Barrels take 300,000,000 cubic feet of lumber each year, fire and insects destroy 1,500,000,000 cubic feet, while the annual growth of our forests is only 6,000,000,000 cubic feet per year. Unless some substitute for wood is discovered and if our supply is suddenly shut off, there would be no more wooden homes, no more newspapers, golf clubs, baseball bats, tennis rackets, telephone poles, etc.



Forest fires each year destroy ten million acres of woodland. This amount of lumber would be sufficient to construct a row of six-room houses on 100-foot lots clear across the United States. When Columbus discovered America, there were 900,000,000 acres of forests here. Of that huge amount, but 125,000,000 acres remain uncut.

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Spider Webs As Fishing Nets

By E. W. GUDGER, *Associate in Ichthyology, American Museum of Natural History*

SPIDERS IN CENTRAL AUSTRALIA WEAVE 15FT. WEBS—THESE NETS WILL OFTEN CATCH BIRDS.

ON this page are shown a number of unique methods of employing spider webs as fishing nets.

In the lower steppes of Central Australia spider webs were found so strong that they were annoying to riders as they rode through the scrub. These webs stretched across from tree to tree for a distance often of 12 to 15 feet and reached a height in the middle of fully 6 feet. The largest spider measured by Spencer and Gillen in Central Australia had a body 2 inches long with a span of spread out legs of 4 inches. So strong is the web of a Madagascar spider that birds are often caught and held in it.

H. B. Guppy while on Treasury Island was anxious to get some small fish to send to the British Museum, but he had no net. His native attendants bent a supple twig into a hoop and spread over it a strong spider web found in the woods near by. The hoop was buoyed up on two parallel sticks, an ant's nest was scattered over the net and the whole was permitted to float down stream. The little fish not noticing the transparent web were attracted by the struggling grubs, and in jumping at these got their snouts and gill covers entangled in the web and were easily caught.

In Fiji the natives bend a piece of reed into a hoop and wave the hoop through spider webs until it is well covered. This appliance used for fishing is practically identical with that employed on Treasury Island and described above.

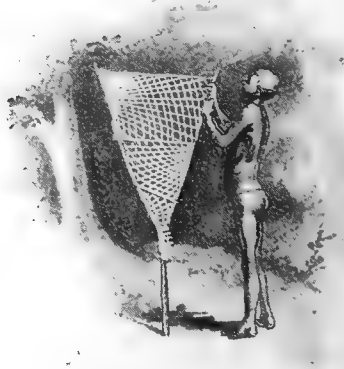
In Trobriand Islands the natives make fishing nets by winding the web of a spider across the fork of a shrub. The web is flat when made, but forms a bag under the weight of the fish. Sometimes one web is employed and on other occasions several webs are used. The webs are hung up to dry after use and may be used many times without breaking. Frequently fish weighing up to three and possibly four pounds are caught in these nets.

In New Guiana, bamboos are bent into the shape of exaggerated tennis rackets and left in the bush where the spiders are the thickest. This accommodating spider finding a convenient framework on hand uses it for the support of a web whose mesh varies from an inch square at the outside to one-eighth of an inch at the center. The native then uses this "made to order" net.

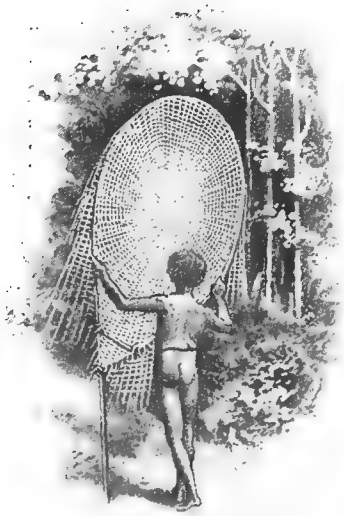
These facts are given in the Zoological Society Bulletin, in an article by the author.

NATIVE SCATTERS ANTS NEST OVER WEB. NET, SUPPORTED ON STICKS, FLOATS DOWN RIVER.

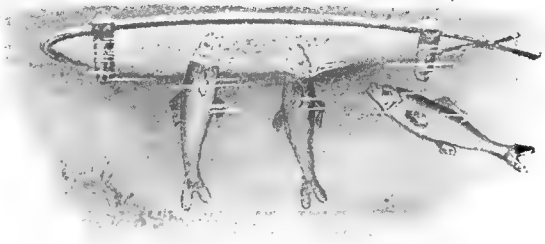
IN FIJI THE NATIVES MAKE NETS BY WAVING BENT REEDS THROUGH WEBS.



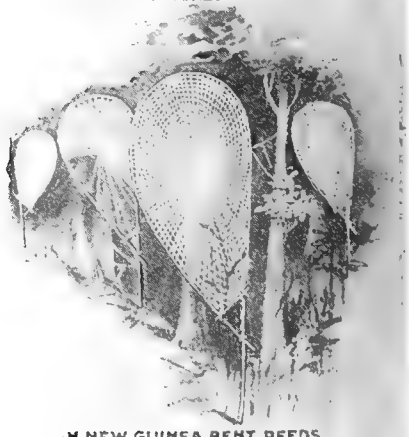
IN TROBRIAND ISLANDS THE NETS ARE WOVEN UPON FORKED STICKS.



ON TREASURY ISLAND NATIVES SPREAD A SPIDER WEB OVER BENT TWIG.



FISH, ANXIOUS TO GET AT FOOD, GET THEIR GILL COVERS ENTANGLED IN WEB.



IN NEW GUINEA BENT REEDS ARE LEFT NEAR BRUSH WHERE SPIDERS ARE THICKEST.

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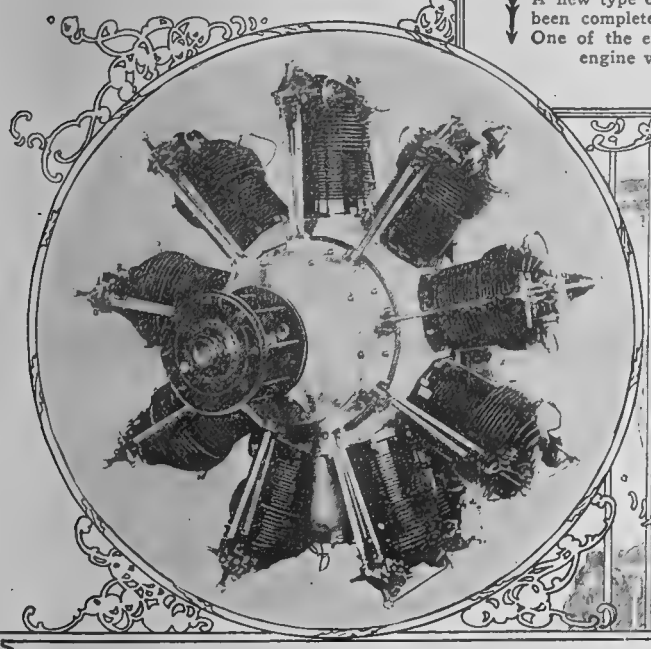
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Latest Styles In Engines

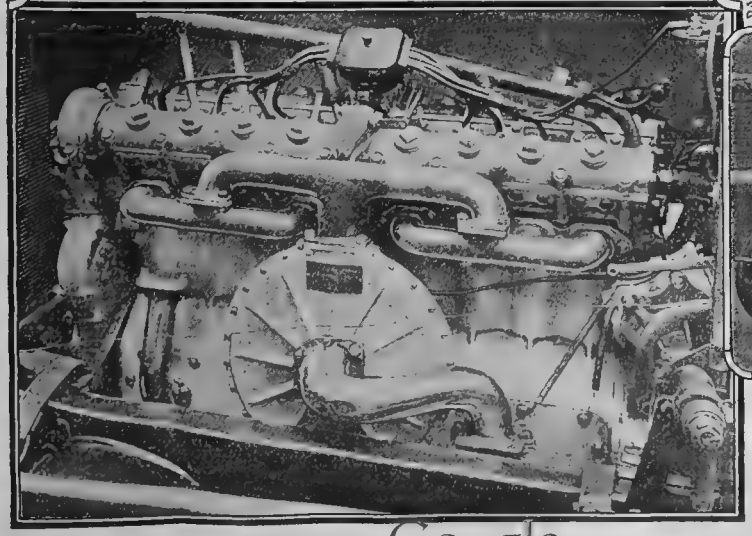
Right: The world's largest and most powerful electric locomotive has been put into service on the Virginian Railway. This locomotive in reality consists of three units semi-permanently coupled together. The result is a locomotive 152 feet long, 1,726,000 pounds in weight and capable of exerting 7,125 horse-power. The engines are made in sections as shown so that they can successfully negotiate curves and can be controlled efficiently. In order to provide for these gigantic locomotives, and to supply them with ample power, the Virginian Railway system has been equipped to handle both 11,000 and 22,000 volts. This is supplied by means of an overhead wire and rail circuit.

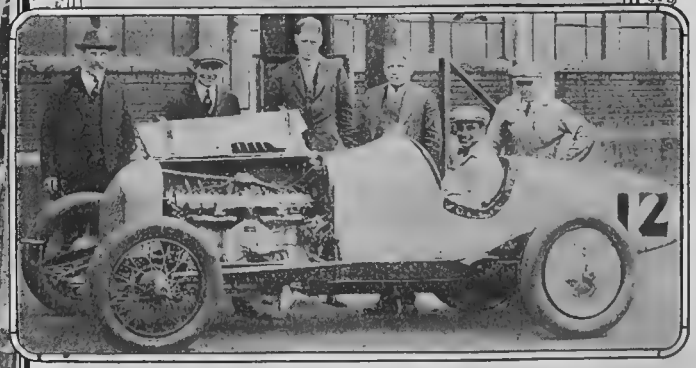
The power taken from the overhead wire is fed into a transformer where the pressure is reduced from the normal high voltage to a comparatively low motor voltage. The single phase power is changed into three-phase and then fed into the main motors. These motors are comparatively simple and rugged in construction and are arranged for two constant running speeds of 14 and 28 miles per hour. The three power unit motors are operated as a single unit and only the controller in the front cab is used.

A new type of radial cylinder air-cooled engine of low weight to horse-power ratio has recently been completed, having been designed especially for the United States Bureau of Aeronautics. One of the engines, delivering 450 horse-power, was substituted for a 400-horse-power Liberty engine with a saving in weight of 285 pounds and a great increase in performance.



Above: The new air-cooled engine. Right: The engine installed in a Douglas plane. With this engine, the plane could climb at the tremendous speed of 12,400 feet in 14 minutes. Much of this increased speed is attributed to the doing away with of the radiator and the consequent reduction in head resistance.

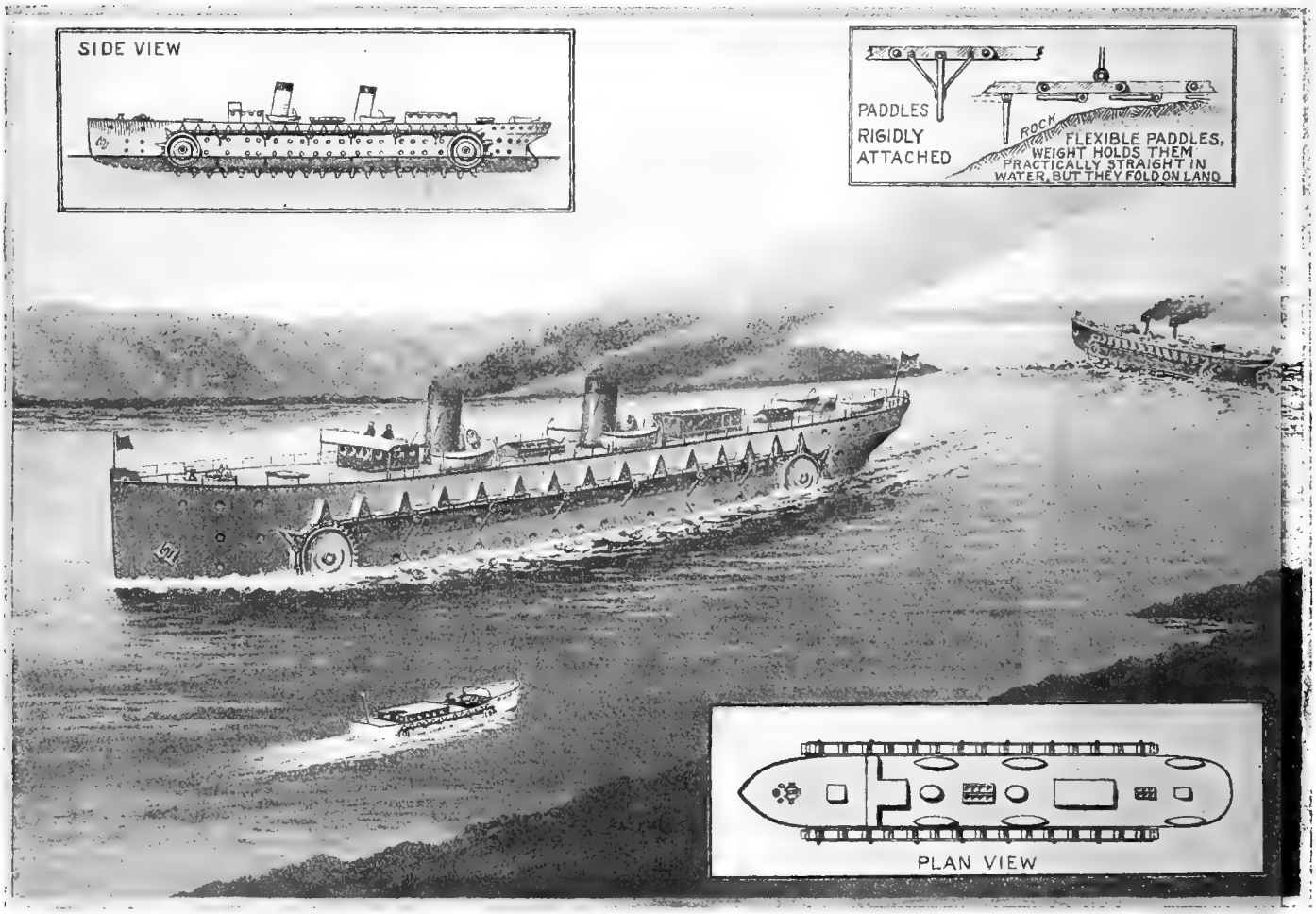




Left and above: A new super-charger for racing automobiles in which the rotating element revolves 30,000 times per minute and is 7½ inches in diameter. The rim velocity is greater than a mile in 5 seconds. This device forces a greater weight of charge into each cylinder, increases compression and thoroughly atomizes the gasoline.

Google

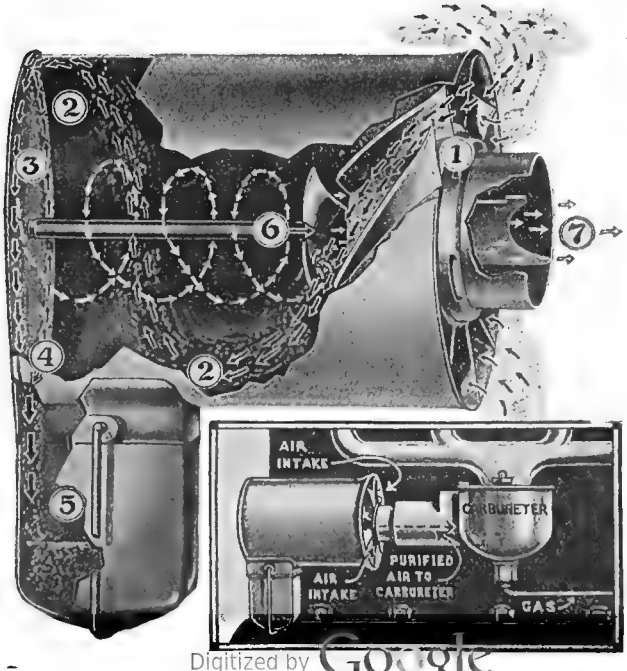
Boat for Shallow Water


SIDE VIEW
PADDLES RIGIDLY ATTACHED
ROCK
FLEXIBLE PADDLES, WEIGHT HOLDS THEM PRACTICALLY STRAIGHT IN WATER, BUT THEY FOLD ON LAND
PLAN VIEW

In rivers where shoals and rocks are often encountered, navigation is most difficult and frequent dredging of the river bed becomes an absolute necessity. However, the use of boats such as illustrated above would eliminate all trouble. With this boat, no propeller is used. On either side of the vessel are placed caterpillar chains resembling somewhat those used on battle tanks. They are equipped with paddles which allow the boat to travel over the obstructions in the water. One flexible type of paddle folds up as shown in the upper right-hand corner of the above illustration and provides traction for the boat over rocks. When in deep water, these paddles serve as propellers. An optional method of construction is also illustrated. In this the paddles are so rigidly fastened that they provide propulsion in water and at the same time give traction on the bed of the river without folding up. Either form of construction would obviously be of great value in some of our inland waters.

—C. Kout Vlastimil.

Air Cleaner



An air cleaner for carburetors is illustrated at the left. The dust-ladened air enters at 1, is whirled by the stationary blades, whereupon the centrifugal force throws the dirt against the sides of the container from whence it enters the removable chamber, 5. Clean air, 7, is supplied to the carburetor.

Hunter's Hat

Often duck hunters in rainy weather are severely handicapped because of the fact that the rain blows into their eyes and cannot be kept out by the ordinary cap visor as such a visor obscures vision. A celluloid insert as above eliminates this possibility.

—Author please send address.

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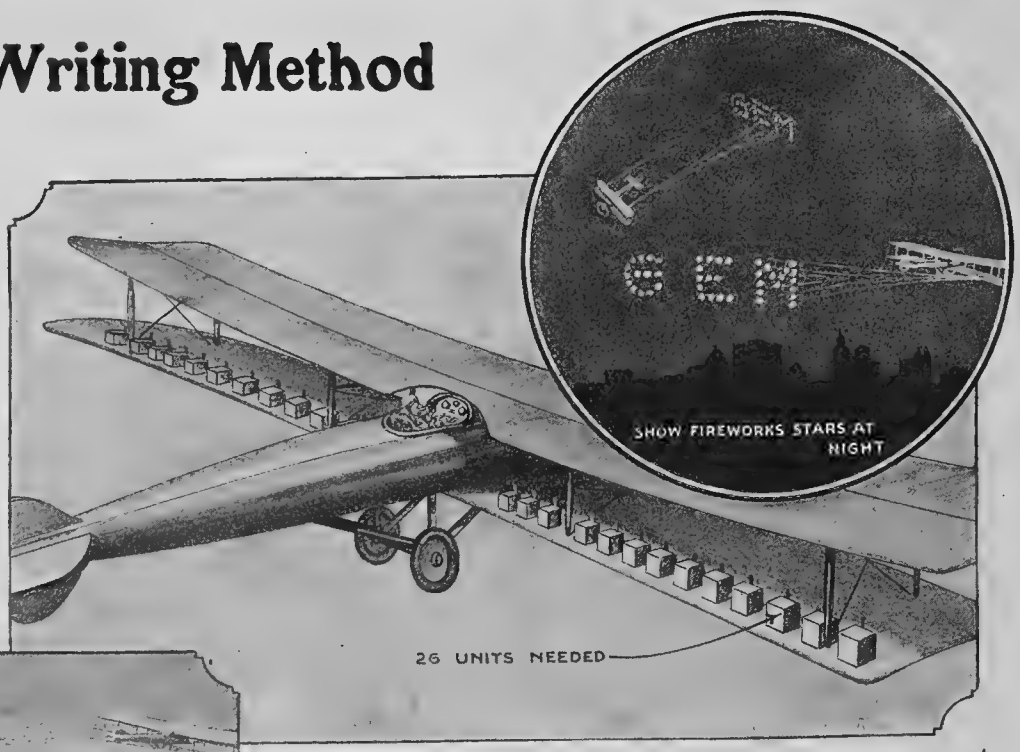
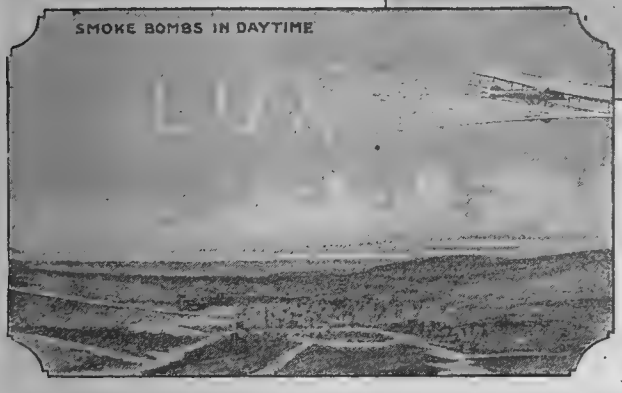
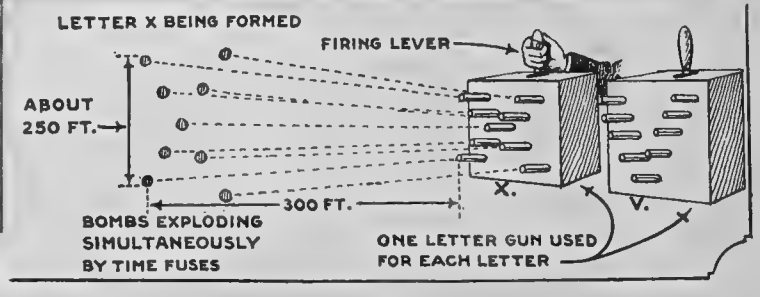
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

New Sky Writing Method

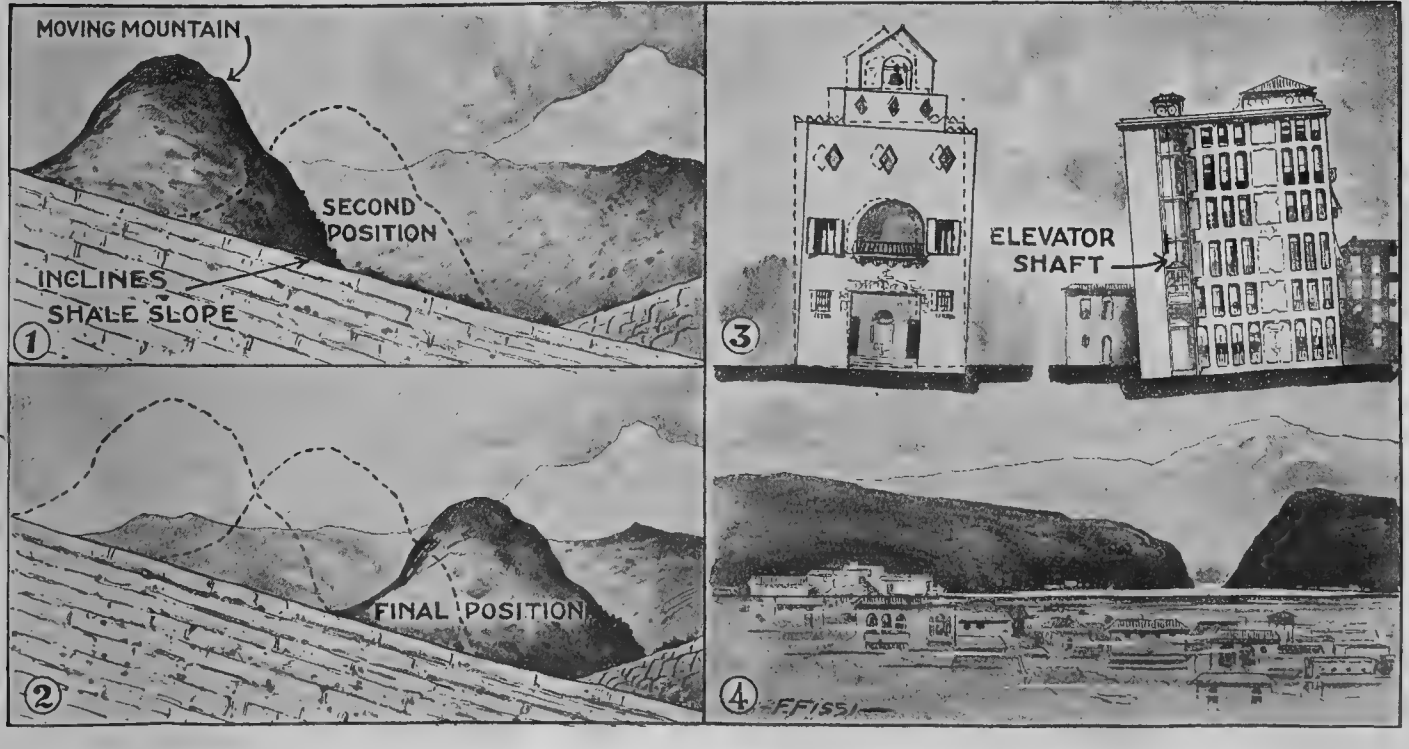
A new method of sky writing, radically different from the well known smoke method, is covered by patents issued to R. D. Bailey of England. The system is illustrated herewith. An airplane flying at a height of approximately one mile or more fires groups of bombs which, bursting into smoke puffs during the day or colored stars at night, are so arranged as to produce letters or numerals as shown in the inserts herewith. The method used is shown in the lower right-hand corner. A combination gun consisting of several barrels arranged as shown ejects bombs equipped with time fuses so that all explode simultaneously. Several units can be arranged along the lower wing of a plane as shown at the right. This method is superior to others in that it is cheaper and faster to produce. A trained stunt pilot is not necessary for the operation.







Earth's Surface Is Shifting



A curious phenomenon has taken place near Meeker, Colo. A mountain 2,000 feet high and containing a hundred million tons of dirt and rock moved as shown in Figs. 1 and 2 at a rate of 2 feet an hour for a space of 150 yards. The mountain has moved a total of a quarter of a mile in 12 years. Buildings in Mexico City are gradually sinking as shown in Fig. 3. Tilting to one side, they present serious engineering difficultes. In some, elevators cannot run. The city is gradually sinking into Lake Texcoco and in 400 years will probably be below water as in Fig. 4.

—Donald H. Menzel, Ph.D.

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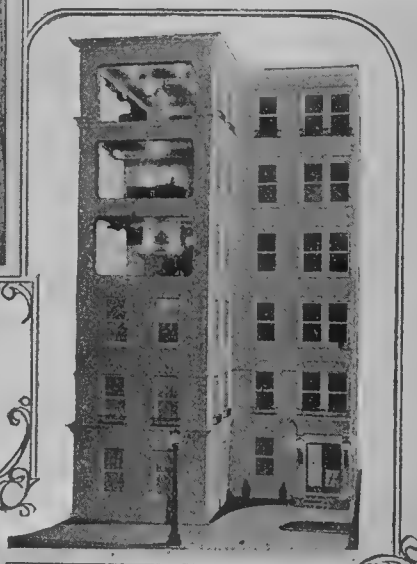
Model of Electrically Equipped Building

Complete Miniature Apartment House Shows Application of Electricity to the Home

The beautifully designed and well lighted entrance to this model apartment house is shown in the photograph directly above. The lighting equipment, although operated from a six-volt source of power, was so designed that perfect results were obtained. The specially built fixtures lost none of their effectiveness through being operated at this low power. As can be seen in the photograph at the right, even tiny street lamps were included in this exhibition.

AT the Architectural and Allied Arts Exposition in New York City, a prominent electrical manufacturing concern had as its part of the various exhibitions a complete model of an apartment house equipped throughout with electrically actuated apparatus for driving pumps, lighting rooms, operating elevators, ventilating, producing cold for refrigeration and heat for warmth and for doing many other jobs such as cooking, ironing, etc. The model was built on a scale of 1 inch to the foot and represented a modern 6-story apartment building. Every feature was carefully worked out by architectural engineers and all of the electric equipment used was designed by electrical engineers. The lighting effects were so worked out as to be quite perfect, and the scale of candlepower was such that each room was illuminated in exactly the same ratio to that which a corresponding sized room in a full sized house would have. Every room in this model was equipped with all the conveniences that could possibly be found in a modern home. Tiny switches, lighting fixtures and outlets for attaching electrical accessories were included in the model. One of the elevators could actually be operated. The equipment for this device included two traction units with their motor generators and control panels built in exact proportion to standard full sized equipment.



Above: A view of the completed model apartment, showing entrance and street lights.

The photograph directly above is a close-up view of the upper three floors of this model apartment house, the walls of which have been cut away so that the spectator can view the complete equipment of the interior. Notice how every part has been reproduced in miniature. At the right, Thomas A. Edison is shown inspecting the model apartment. He is said to have been well pleased with the accuracy of every small detail.

In the photograph above the electrical equipment placed in the basement of this model apartment house is being inspected. Here are to be found entrance switches, transformers, circuit breakers, motors and motor generators with their necessary switchboards, starters and safety switches. The motors drive pumps, ventilating fans and refrigeration machinery.

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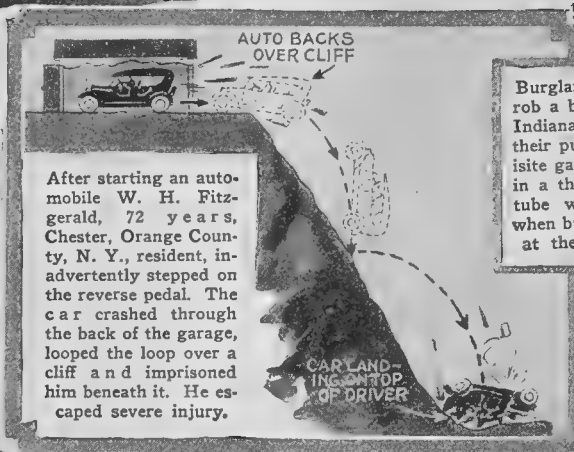
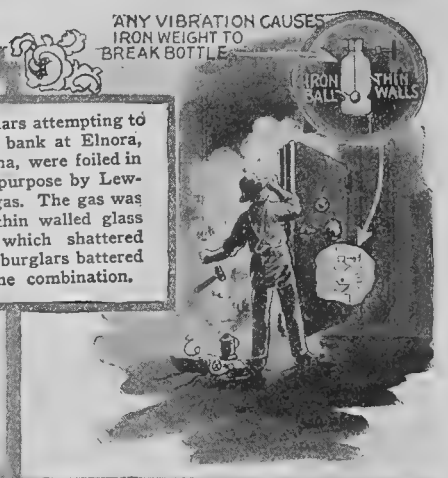
This Months News Illustrated

By GEORGE WALL

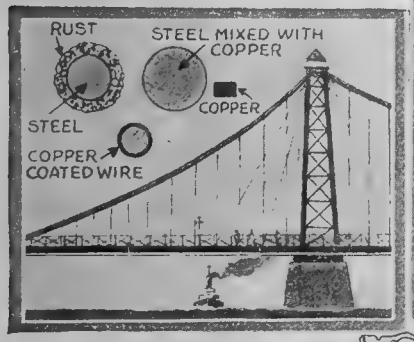
The United States Shipping Board freighter Sauges bound from Spain for New York was impinged on the submerged ledge of an iceberg and held there for four hours.



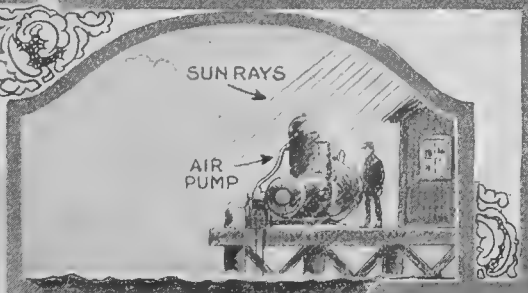
After starting an automobile W. H. Fitzgerald, 72 years, Chester, Orange County, N. Y., resident, inadvertently stepped on the reverse pedal. The car crashed through the back of the garage, looped the loop over a cliff and imprisoned him beneath it. He escaped severe injury.



Burglars attempting to rob a bank at Elnora, Indiana, were foiled in their purpose by Lewisite gas. The gas was in a thin walled glass tube which shattered when burglars battered at the combination.

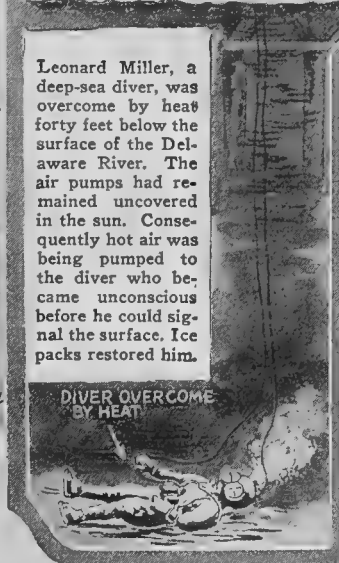


It has been definitely determined that iron and steel are almost entirely rustless when a small amount of copper is mixed with either the iron or steel. This alloy should save much money.

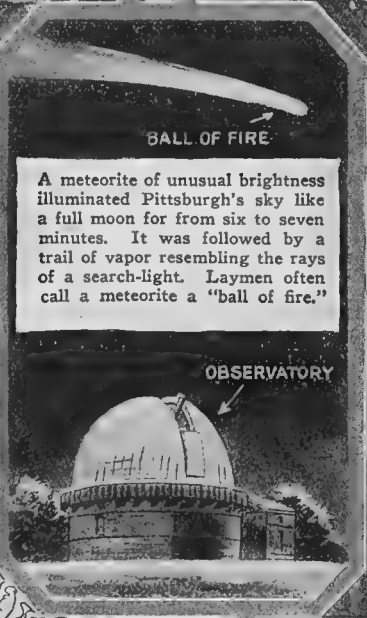


Woodchucks are being poisoned by the farmers of Sullivan County by closing all the run openings immediately after a wad of cotton saturated with calcium cyanide has been dropped in the run. A poisonous gas forms, killing the animals.

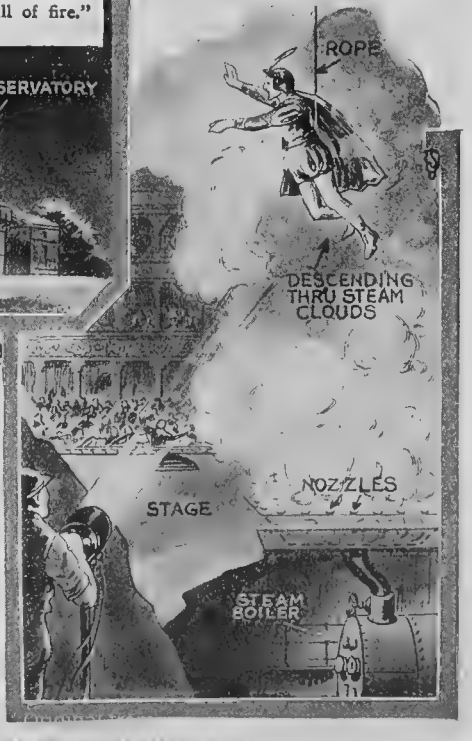
A report from France states that a bolt of lightning from a cloudless sky killed a girl. American scientists question the authenticity of this report. Lightning rarely, if ever, comes from a cloudless sky.



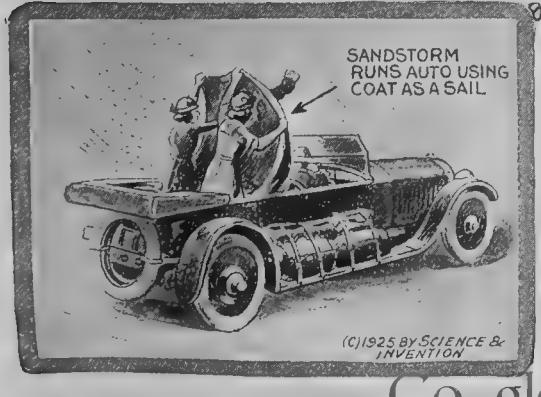
Leonard Miller, a deep-sea diver, was overcome by heat forty feet below the surface of the Delaware River. The air pumps had remained uncovered in the sun. Consequently hot air was being pumped to the diver who became unconscious before he could signal the surface. Ice packs restored him.



A meteorite of unusual brightness illuminated Pittsburgh's sky like a full moon for from six to seven minutes. It was followed by a trail of vapor resembling the rays of a search-light. Laymen often call a meteorite a "ball of fire."



An unusual stage effect was accomplished on the stage of the Grand Opera at Paris, France, when the principal character descended through a cloud of steam. The steam cloud evaporated over the heads of the spectators. The effect was enthusiastically received.



The cartoonist of the Chicago Tribune, John T. McCutcheon, recently actually sailed the Gobi Desert in a fourteen-hundred-pound car. A sandstorm filled the magneto and carburetor with sand, stalling the car. The women of the party held up a sheepskin coat making a sail of it and after giving the car a start the seventy mile gale carried it along.

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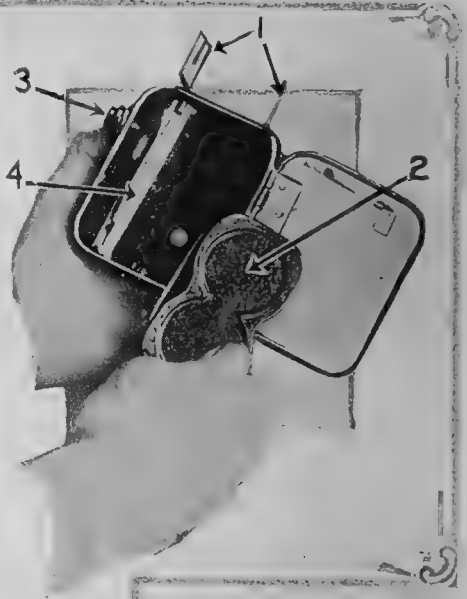
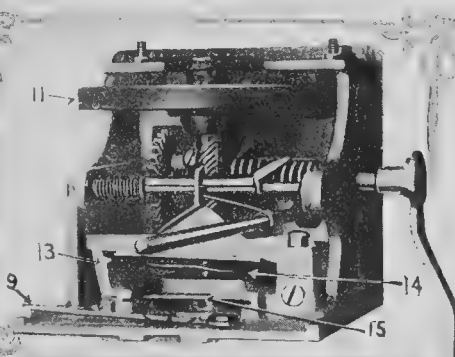
Take Your Own Movies

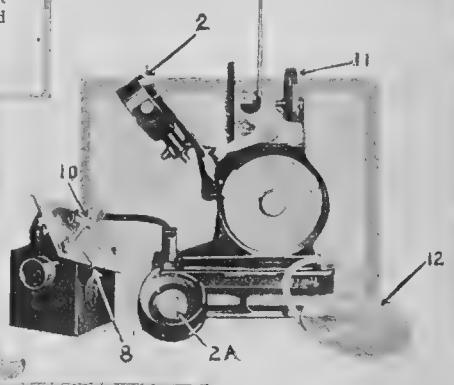
By JOSEPH H. KRAUS

The above photo shows the motion picture camera mounted on a tripod and ready for use. The device is small, neat and compact. It does not weigh any more than an ordinary vest pocket camera. The negative is reversed when it is developed and becomes the positive used for projection.

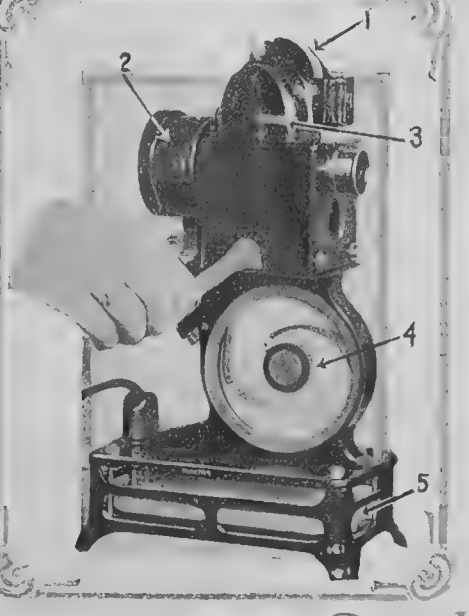
The photo at the right depicts the daylight loading of the new motion camera. The film cartridge, 2, is being placed in the camera. The film is slid over the pressure plate, 4. The numeral 3 indicates the lens of the camera and 1 is the finder. Each roll contains enough film to produce about 1200 individual pictures. Some of the prints are so perfect that they may be thrown up on a 9 X 12-foot screen with ease, using the projector shown on this page.





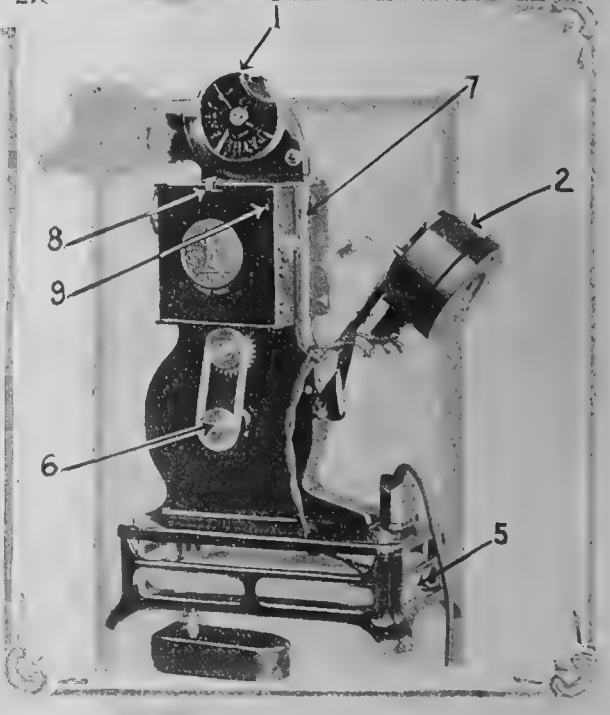


The photo at the left shows the projector with the housing removed. Fig. 2 shows the housing for the 12-volt lamp used in the projector. 2A is the back cover of this housing with the reflector clearly indicated. At 8 we see the arm for focusing the projection lens, 10. The flywheel is indicated at 11 which incidentally acts as a shutter for the projector, and the piece of glass at 12 covers the film take-up reel.



The photo above and to the left is a top view of the projecting mechanism. The flywheel and shutter are shown at 11. The lever for framing the picture is illustrated at 9. A strange feature of this projector is that instead of wasting many feet of film when titles for the pictures are thrown upon the screen, but one frame is necessary as the film automatically stops while the title is being projected. This is due to the fact that the lever, 13, assumes the position illustrated which releases the film engaging pawl, 14.

The two photos at the bottom of this page show the projecting mechanism. The numeral 1 indicates the film which is to be projected, and the lamp housing is shown at 2. The film rewind is integral with the projector and the handle operating it is shown at 3. Focusing is done with the lever, 8. The film take-up is automatic and need not be threaded. This is illustrated at 4. Beneath the entire apparatus there is a resistance and rheostat for cutting down the lamp current.



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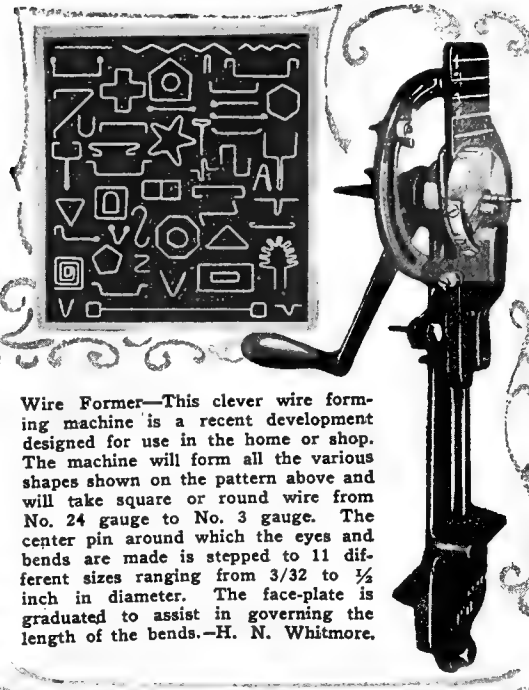
This Month's Latest Devices

The above photo shows Mrs. E. M. Bolton, grandniece of Sir Humphrey Davy, the inventor of the Miner's Safety Lamp, inspecting some inventions designed for housewives.

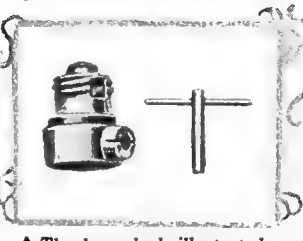
A Milk Bottle Holder is illustrated here. You signify the milk or cream you want by placing your coin in one of the holders.
—J. B. R.



Wire Former—This clever wire forming machine is a recent development designed for use in the home or shop. The machine will form all the various shapes shown on the pattern above and will take square or round wire from No. 24 gauge to No. 3 gauge. The center pin around which the eyes and bends are made is stepped to 11 different sizes ranging from 3/32 to ½ inch in diameter. The face-plate is graduated to assist in governing the length of the bends.—H. N. Whitmore.

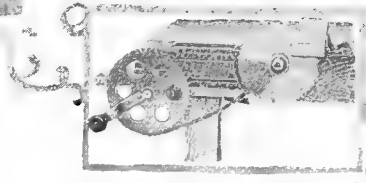
The swimmer's glove shown above is made of canvas and is strapped around the wrist of the wearer. Due to its web-foot construction great speed is possible.

Tonsorial Aid—This device is made of a piece of celluloid which fits the back of the head. The lower edge of the sheet can be trimmed square or round. It is slit vertically, giving it close conformity to the neck. The safety razor glides smoothly over the lathered celluloid and begins to cut when it meets the hair on the neck. —Murray Schick.

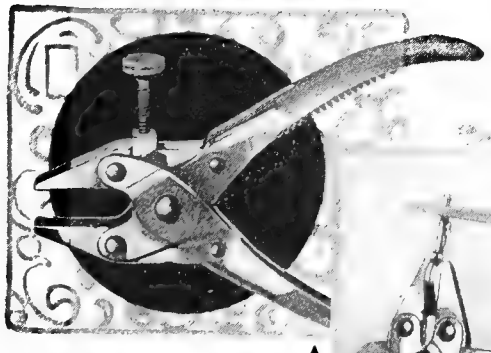


The lamp lock illustrated above automatically locks in the socket and secures the lamp bulb, preventing its removal.
—H. Klein.

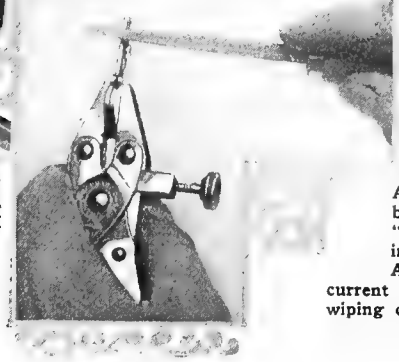
The device to the left is a copyholder spacer and sight reader. The copyholder has a magnifying glass so as to magnify the shorthand or other notes.
—George C. Hohein.

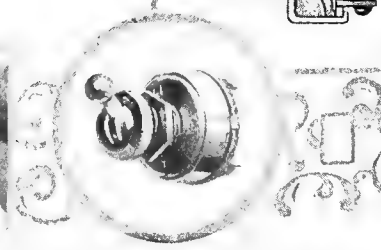


The hand-driven carpenters' circular saw, illustrated above, has an automatic feed which guides the saw through the cut. The device is fitted with a miter gauge which holds the work at any angle.

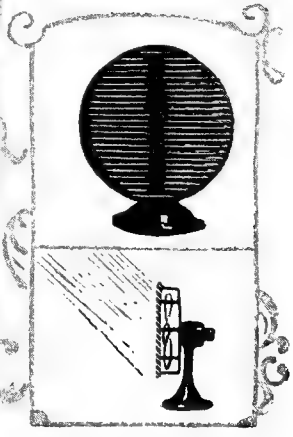


The ingenious hand vise pliers, illustrated here, may be used as ordinary pliers or as a vise. When used as a pair of pliers great leverage is obtained. The jaws are always parallel. The thumbscrew makes a vise of the pliers whenever it is tightened.





Above is shown a new type of toggle battery switch for use in controlling "A" battery circuits in radio sets. To install it, but one hole need be drilled. A flip of the operating lever turns the current on or off. The switch has a large wiping contact as illustrated in the cross-sectional diagram above.



The air circulator illustrated above may be attached to any electric fan. It throws its air upward, preventing drafts.

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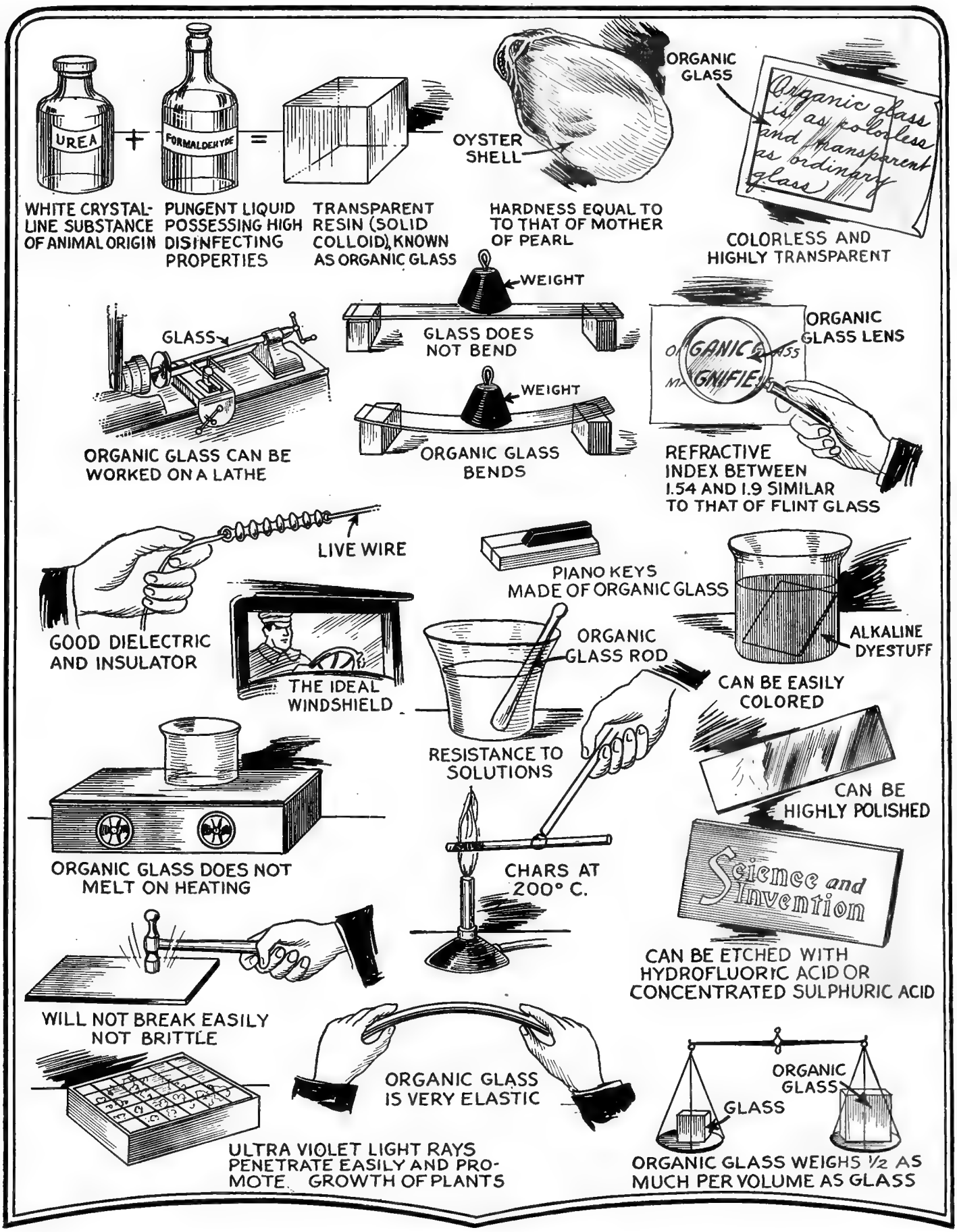
Characteristics of Organic Glass


UREA
FORMALDEHYDE
WHITE CRYSTALLINE SUBSTANCE OF ANIMAL ORIGIN
PUNGENT LIQUID POSSESSING HIGH DISINFECTING PROPERTIES
TRANSPARENT RESIN (SOLID COLLOID), KNOWN AS ORGANIC GLASS
ORGANIC GLASS
OYSTER SHELL
HARDNESS EQUAL TO TO THAT OF MOTHER OF PEARL
Organic glass is as colorless and transparent as ordinary glass
COLORLESS AND HIGHLY TRANSPARENT
WEIGHT
GLASS DOES NOT BEND
GLASS
ORGANIC GLASS CAN BE WORKED ON A LATHE
WEIGHT
ORGANIC GLASS BENDS
ORGANIC GLASS LENS
REFRACTIVE INDEX BETWEEN 1.54 AND 1.9 SIMILAR TO THAT OF FLINT GLASS
LIVE WIRE
GOOD DIELECTRIC AND INSULATOR
PIANO KEYS MADE OF ORGANIC GLASS
THE IDEAL WINDSHIELD
ORGANIC GLASS ROD
RESISTANCE TO SOLUTIONS
ALKALINE DYESTUFF
CAN BE EASILY COLORED
CAN BE HIGHLY POLISHED
ORGANIC GLASS DOES NOT MELT ON HEATING
CHARS AT 200° C.
Science and Invention
CAN BE ETCHED WITH HYDROFLUORIC ACID OR CONCENTRATED SULPHURIC ACID
WILL NOT BREAK EASILY NOT BRITTLE
ORGANIC GLASS IS VERY ELASTIC
ULTRA VIOLET LIGHT RAYS PENETRATE EASILY AND PROMOTE GROWTH OF PLANTS
ORGANIC GLASS
GLASS
ORGANIC GLASS WEIGHS ½ AS MUCH PER VOLUME AS GLASS

Organic glass, a solid transparent resin, is made by the combination of a crystalline substance and a liquid and possesses many characteristics that make it valuable for use in places where ordinary glass would be impractical. The most important of these points that show the advantages of this new synthetic material are graphically shown in the various illustrations above and described in detail opposite.

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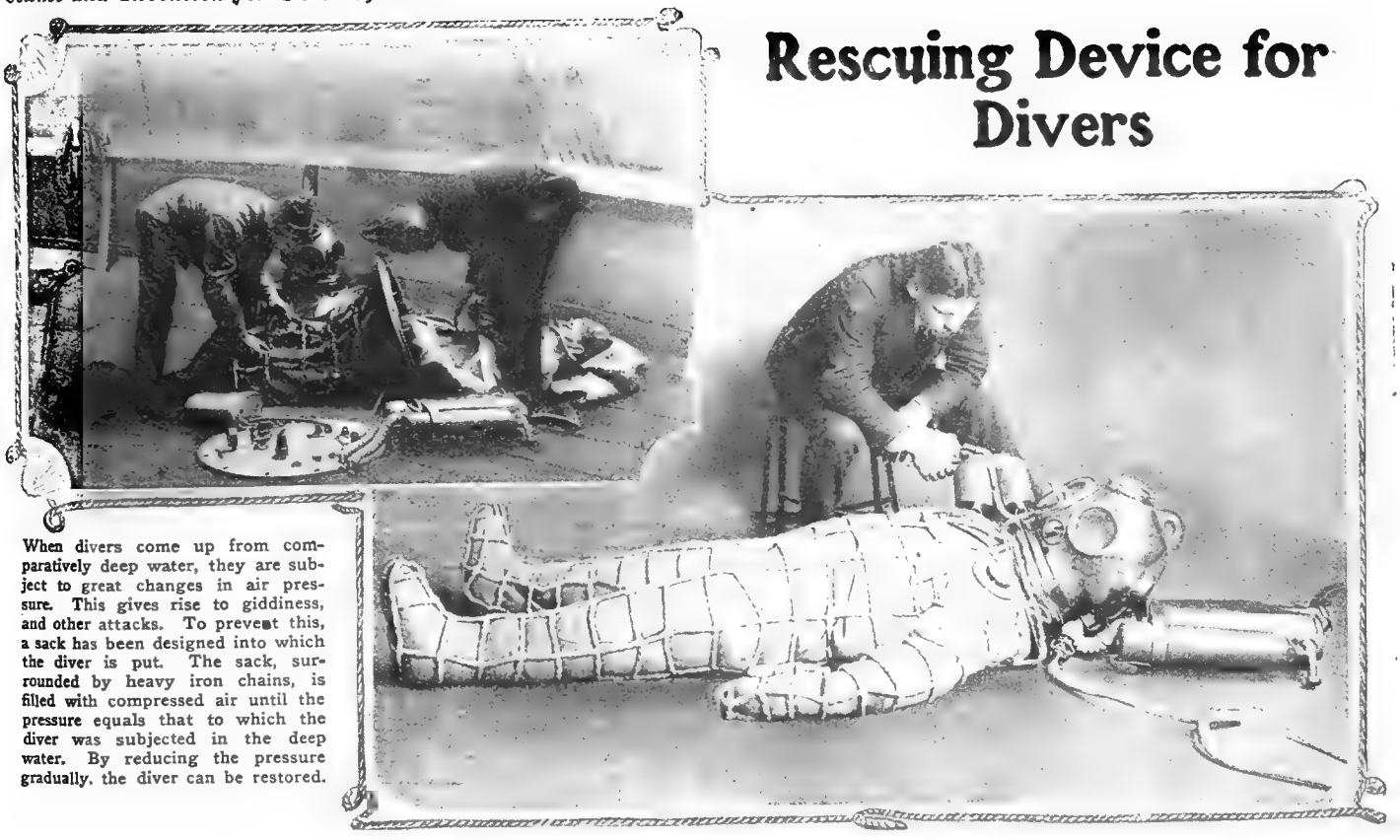
Rescuing Device for Divers



When divers come up from comparatively deep water, they are subject to great changes in air pressure. This gives rise to giddiness, and other attacks. To prevent this, a sack has been designed into which the diver is put. The sack, surrounded by heavy iron chains, is filled with compressed air until the pressure equals that to which the diver was subjected in the deep water. By reducing the pressure gradually, the diver can be restored.

Organic Glass

Pictures on Opposite Page Illustrate Its Many Practical Properties

By ISMAR GINSBERG, B. Sc., Chem. Eng.

GLASS, as we know it, is an inorganic substance, a substance that will not burn, that possesses many advantageous as well as disadvantageous properties. Now along comes a new product, made with the aid of a new sort of chemistry, a material that has most of the good qualities of glass and none of its bad ones, a substance that looks like and acts like glass in many respects, but one that will burn.

It is a new synthetic resin, called pollopas, made by condensation processes, just like bakelite and other synthetic resins, by the action of formaldehyde on a simple organic chemical, urea. The new resin is perfectly transparent, elastic, magnifying when made into a lens, has considerable strength and a fair degree of hardness. It will not splinter when broken. It takes a brilliant polish. It is transparent to the ultra-violet rays. It refracts light very much like flint glass. It can be machined and cut with ease. It is colored readily with various coloring matters.

It is a brand-new substance, something that has never before been made and in whose manufacture there are applied new applications of chemistry and apparatus of a type never before constructed are employed. Its uses are legion. In the accompanying illustrations only a few of its more manifest and more important applications are exemplified. Our readers will undoubtedly find some use for it in their work, no matter what that might be. Organic glass is a real chemical achievement!

The substance, much of the bakelite nature, is a synthetic resin, to which class of compound a great deal of attention has been given in the last few years.

Formaldehyde, which had considerable notoriety in the last few years as a milk preservative, disapproved by health boards, has the curious property of hardening certain chemical compounds, producing the synthetic resins alluded to above by breaking up and recombining its own and their constituents. The record discs of some phonographs now on the market are an example of a formaldehyde product.

The organic glass we are speaking of is treated at some length in a little pamphlet published in Austria and giving the trade name of the product as Pollopas. It contains a long description of the troubles encountered by the chemists evolving it and is rather abstruse. When at last they reach the point where trouble disappears, they regretfully state that the detailed description of the work has been deposited in a "sealed document" to prove priority.

The great desire, which appears repeatedly expressed in the text, is the production of a substance which can be turned on the lathe. But the new substance possesses such interesting qualities that its adaptability to lathe work takes a minor place.

Pollopas is colorless and transparent and takes a high polish and is very brilliant when so treated. It passes rays of light of the ultra-violet region, so in this feature it can sometimes replace quartz glass.

Its refractive index is quite high, comparable to the highest figure of flint glass, and lies between 1.5 and 1.9. This variation makes the new colloid or synthetic resin applicable to the construction of achromatic combinations.

It is so soft, however, that it can only hope to be used for protected and carefully guarded lenses, as it is a little softer than calc spar, the transparent crystalline form of calcium carbonate, now rather a rarity. Yet is believed that in course of time it will be applicable for large telescope lenses. These are objects of the greatest care, and scratching is hardly to be apprehended in their case. The phonograph disc spoken of above is of about the same hardness.

Its specific gravity is 1.44 or about one-half that of some varieties of glass. It is lighter than ivory, whose specific gravity is 1.7 to 1.9.

It is very strong and highly elastic. Its heat conductivity lies between that of glass and of porcelain; it conducts heat better than crown glass and worse than porcelain. Its electrical conductivity is too high to make it of use as an insulator, but hopes are entertained that it will be improved in this respect.

On being heated it chars at a temperature of about 200 degrees C. (392 degrees F.) so it is comparatively safe in regard to fire and ignition.

A curious feature is that it can be etched with hydrofluoric acid or concentrated sulphuric acid.

By stopping half way in the production of the solid product, a colloidal solution is obtained which can be used as an ingredient in a borax solution of shellac as an adhesive and for the manufacture of lacquers.

Another everyday use is for the windshields of automobiles, as it will not splinter when it breaks.

Every day we read in the newspapers of auto accidents in which the occupants have been severely cut, if not mortally injured by flying glass. Organic glass will find hundreds of other uses such as for decorative purposes, etc.

There is an old story to the effect that in ancient days a sample of glass which could be hammered and bent without breaking was shown to one of the monarchs, who, the writer believes, is said to have killed the inventor to prevent interference with the regular glassworks of the country. Correctly or incorrectly told, this story is decidedly uncertain, but it is interesting to know that malleable glass has now been produced.

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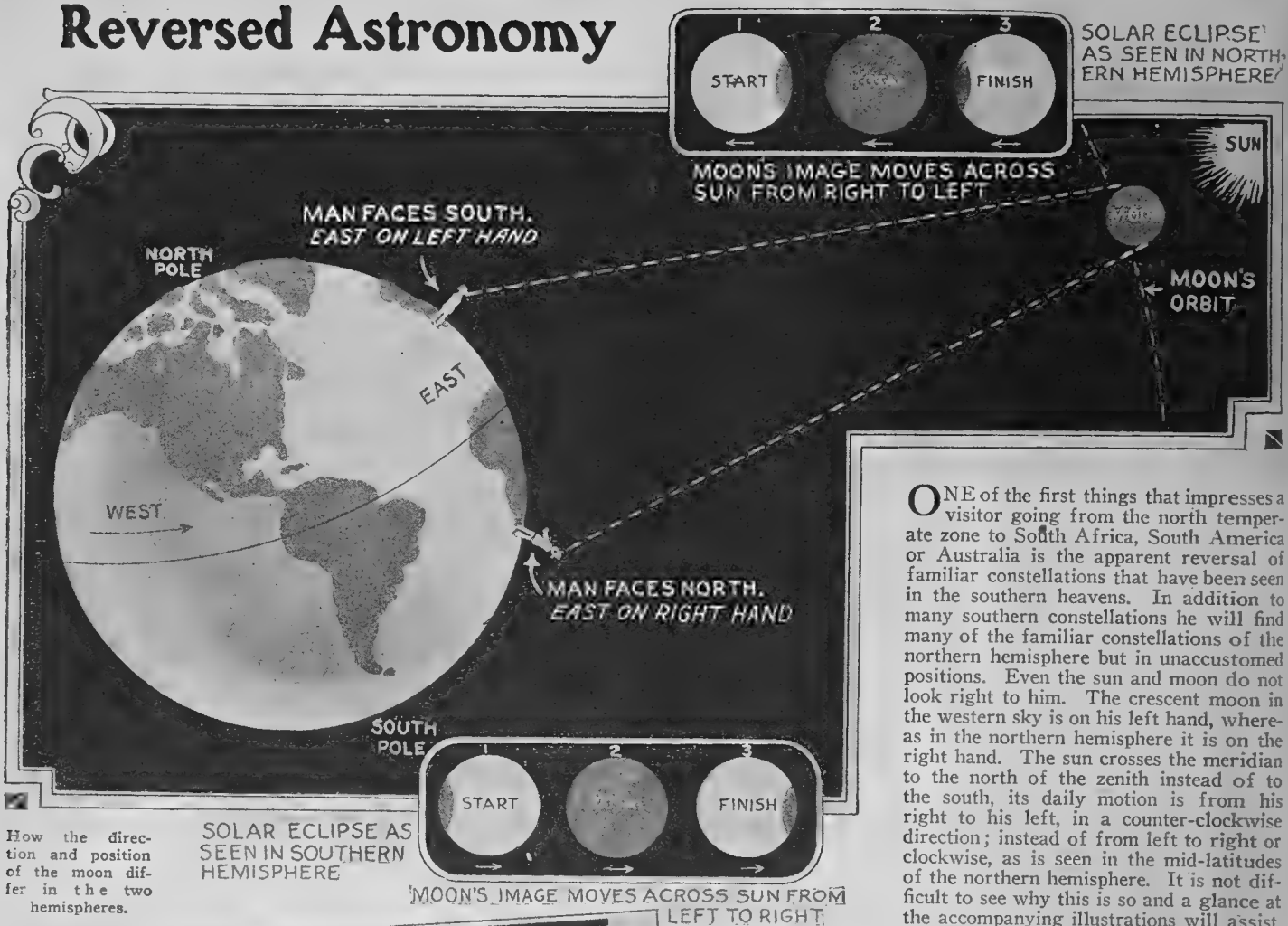
Reversed Astronomy



How the direction and position of the moon differ in the two hemispheres.

ONE of the first things that impresses a visitor going from the north temperate zone to South Africa, South America or Australia is the apparent reversal of familiar constellations that have been seen in the southern heavens. In addition to many southern constellations he will find many of the familiar constellations of the northern hemisphere but in unaccustomed positions. Even the sun and moon do not look right to him. The crescent moon in the western sky is on his left hand, whereas in the northern hemisphere it is on the right hand. The sun crosses the meridian to the north of the zenith instead of to the south, its daily motion is from his right to his left, in a counter-clockwise direction; instead of from left to right or clockwise, as is seen in the mid-latitudes of the northern hemisphere. It is not difficult to see why this is so and a glance at the accompanying illustrations will assist. In our northern latitudes we must face south to observe the sun, the moon and the equatorial and zodiacal constellations cross the meridian. Here the motion of the heavens appears to be from left to right or clockwise. In the southern hemisphere we must face north in order to observe the same heavenly bodies and they will cross the meridian to the north of the zenith. This places east on the on the right and west on the left. As shown, views of solar eclipses differ in the hemispheres for the same reason that is given above.

—Isabel M. Lewis, M. A.

THE Scorpion lies south of the celestial equator and the northern observer sees the long line of stars that constitute the creature's tail trailing southward toward the southern horizon. This can be demonstrated by the use of a card upon which a reproduction of the constellation is drawn. Holding this in different positions and toward first the northern and then the southern horizon, the reason for the reversal of the constellations when viewed from different places will be seen.

At the right is shown the same constellation, Scorpio, as it appears in the southern temperate zone in mid-winter. It appears above the northern horizon, the tail, instead of pointing toward the horizon as above, is directed away from that line toward the zenith, while the fiery Antares that is above the line of stars that constitute the tail of the Scorpion in our latitudes is below the same line of stars when viewed in the southern hemisphere. In the southern hemisphere, this constellation crosses the northern heavens in a counter-clockwise direction.

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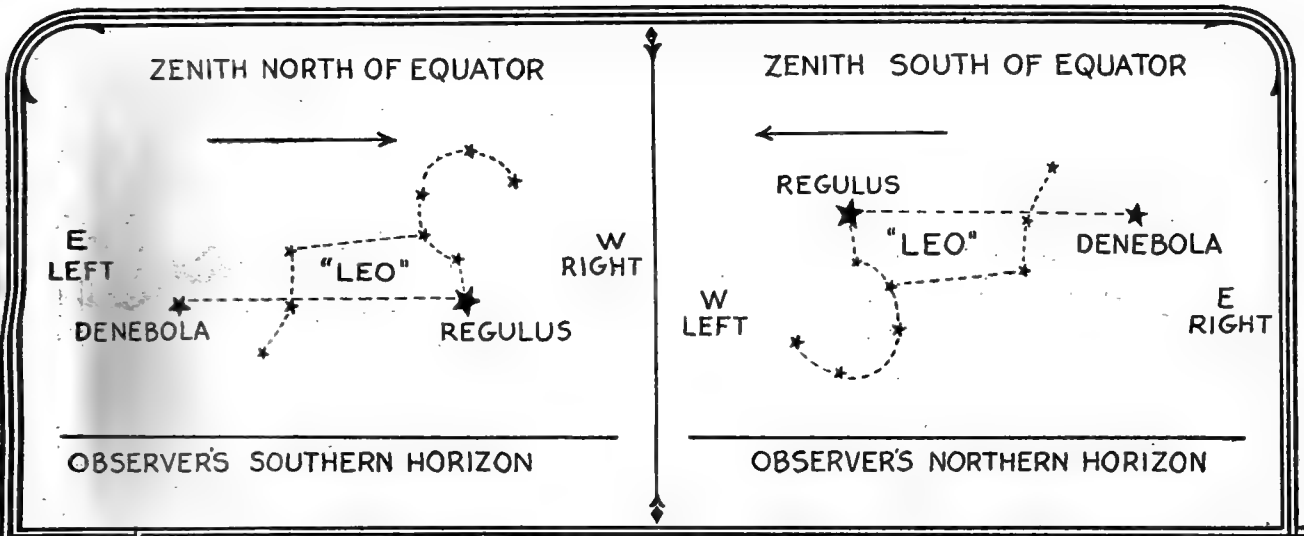
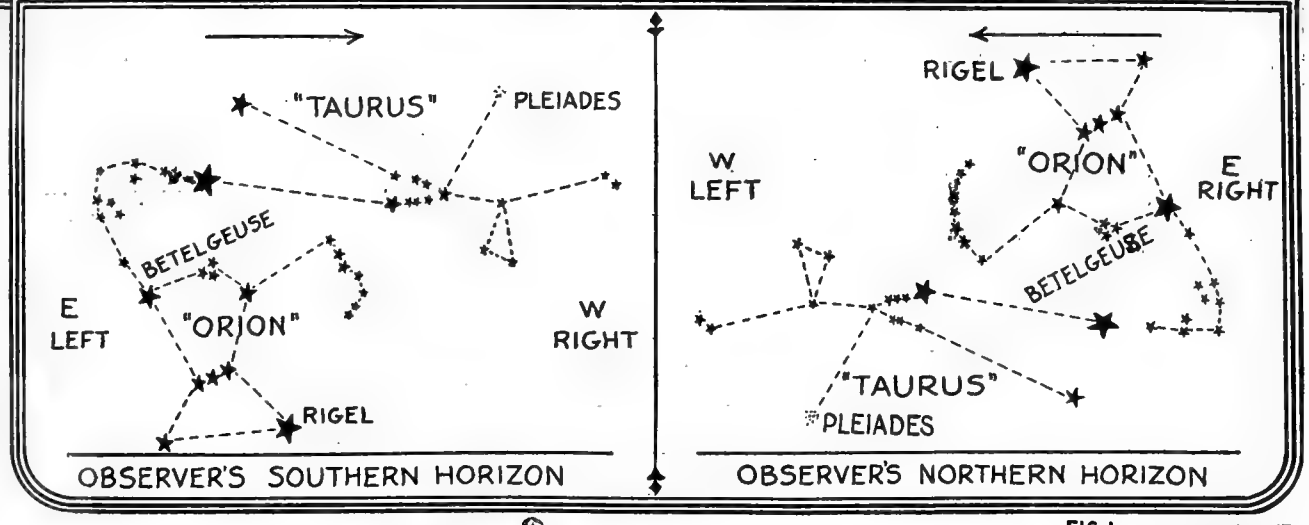


Leo, the constellation with the sickle-shaped group of stars, appears to be inverted when viewed first from one hemisphere and then from the other.



The same thing is true with Orion, Taurus and the Pleiades as shown and with all other constellations. They appear in the different positions shown when viewed first north and then south of the equator.

Magic Painting

A sheet of white paper is pinned to a drawing board, supported on an easel as shown. With a large brush the exhibitor paints on the paper and in a few moments hands a large black and white painting to the audience. The secret of the performance is as follows: An enlargement of the size that the "painting" is to be, is made on bromide paper from a negative, and developed only faintly. After fixing and washing, the print is bleached in a solution of 100 parts of water and 5 parts of mercury chloride. Wash thoroughly and the sheet will appear white. Dry in darkness. The solution that is used by the operator for bringing out the illustration is 15 parts of sodium sulphite in 100 parts of water.

—C. A. Oldroyd, Rep. 4433.

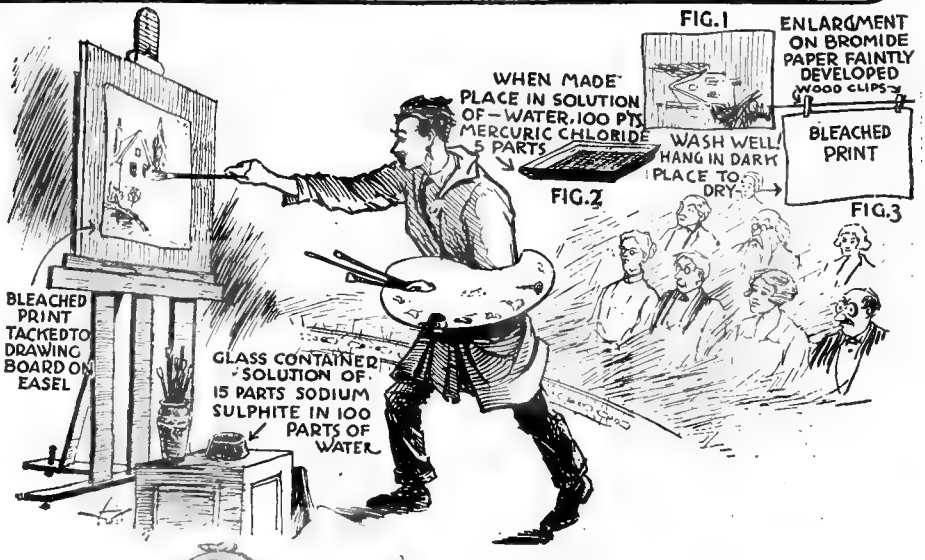


FIG.1
ENLARGMENT ON BROMIDE PAPER FAINTLY DEVELOPED
WOOD CLIPS
WHEN MADE PLACE IN SOLUTION OF—WATER, 100 PTS MERCURIC CHLORIDE 5 PARTS
FIG.2
WASH WELL HANG IN DARK PLACE TO DRY
BLEACHED PRINT
FIG.3
BLEACHED PRINT TACKED TO DRAWING BOARD ON EASEL
GLASS CONTAINER SOLUTION OF 15 PARTS SODIUM SULPHITE IN 100 PARTS OF WATER

Renovating Furniture

The kiddies' table and chair illustrated at the extreme left were made from an old table and chair that outlived their usefulness to the grown-ups. First the legs were cut off so as to reduce the height sufficiently, a few nails and screws were judiciously distributed among weak joints and a coat of paint made a very presentable set out of some old furniture that was slated for the junk pile. The pretty little dresser which is also shown is an old kitchen table which has been given a coat of enamel and decorated with a curtain of cretone.

—S. Goehns

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Visibly, we were free, with open, unbarred arches and casements. But to pass through one of them, the barring current struck you like a wall, with darting sparks when it was touched.

Tarrano the Conqueror

FOURTH INSTALLMENT

By RAY CUMMINGS

First American & Canadian Serial Rights

SYNOPSIS

THE story opens in the year 2325 and is related by Jac, a writer of that time, employed by a large news organization of Great New York. On the afternoon of May 12 of that year, the President of the Anglo-Saxon republic is murdered in the midst of a speech. This happened at 5:10 P.M. At 6:15 of the same day the ruler of Allied Mongolia is murdered. Ten minutes later the leader of the negroes of Africa is killed while asleep. This leaves the earth without leadership. Jac and Grayson, a co-worker of his, suspect that the murders are the result of a plot on the part of the inhabitants of Venus. At 8:26 the mail from Venus lands. At 8:44 a message by helio from that planet announces the murder of the ruler of the Venus Central State. A warning comes with the same message and reads in part, "City being attacked . . . Tarrano, beware . . . . you are in danger of . . . ." The message stops at this point and further communication is impossible.

At 9 P.M. Jac is summoned to Northeast Island, off the coast of Maine, by a Dr. Brende. He goes and is welcomed by the Doctor and informed that the Martian ruler of the Little People had also been assassinated and at the same time communication had become impossible with Mars.

Tarrano, the Doctor states, was at one time a lower official of the Cold Country of Venus. The doctor then announces that he, Brende, has perfected a medical method whereby human beings may be kept from growing old.

Unable to communicate with the Doctor's laboratory in northern Siberia, they set out for that point in Brende's aero. Arriving there they find no one outside and upon entering the laboratory building, are set upon by a group of "Venus-men."

In the ensuing battle, the Doctor is killed and Jac, Elza, the Doctor's daughter, and Georg, the Doctor's son, are taken from the laboratory by Argo, a Venus-man. They are transported in an aero to Venia, a city on the earth inhabitated by people of Venus. Here they meet Tarrano, who orders Jac and Georg imprisoned, keeping Elza in his presence. He starts to make love to Elza.

CHAPTER VII

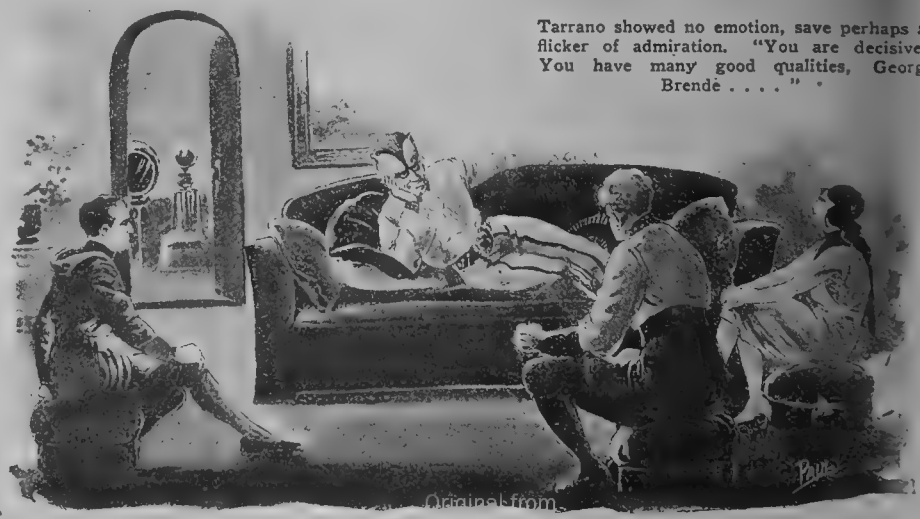
PRISONERS OF THE TOWER

FROM the garden where Tarrano was talking with Elza, the Marsman Wolfgar led us to the tower in which we were to be imprisoned. Quite evidently it had been placed in readiness for us. A tower of several rooms, comfortably equipped. As we crossed the lower bridge and reached the main doorway, Wolfgar unsealed a black fuse-box which stood there, and pulled the relief-switch. The current, barring passage though every door and window of the tower, was thrown off. We entered. My mind was alert. This man of the Little People could not again turn on that current without going outside. Once it was on, like an invisible wall it would prevent our escape. But now—could not Georg and I with our superior strength overpower this smaller man?

I caught Georg's glance as our captor led us into the lower room—an apartment cut into the half-segment of a circle, Georg, at my elbow, whispered: "No use! Where could we go? Could not get out of the city——"

The hearing of the Little People is sharp. Wolfgar turned his head and smiled. "You will be quite secure here—do not think of escape." His bronzed fingers toyed with a cone at his belt. "Do not think of it."

Soon he left us, with the parting words: "You may use the upper circle of balcony. The current rises only from its rail." He



Tarrano showed no emotion, save perhaps a flicker of admiration. "You are decisive. You have many good qualities, Georg Brende . . . ."

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smiled and left us. A pleasant smile; I felt myself liking this jailor of ours.

We took a turn of the tower. There were three bedrooms; a cookery, with food and equipment wherein evidently it was intended that Elza could prepare our meals; and two bath-apartments, one of them farily luxurious, with a pool almost large enough for a little swimming; tubes of scent for the water and the usual temperature rods.

"Well," I remarked. "Obviously we are to be comfortable." I was trying to be cheerful, but my heart was heavy with foreboding nevertheless. "How long do you suppose they'll keep us here, Georg? And what——"

His impatient gesture stopped me. His mind was on Elza—alone down there in the garden with Tarrano. As was mine, though I had not wanted to speak of her.

There was an instrument room, up the circular incline in the peak of the tower! We heard the hum of it; and when we went up there, the first thing we saw was a mirror tuned in readiness for us to view the garden we had just left. This strange Tarrano, giving Georg the visible proof that he would keep his word and not harm Elza. We could see in this mirror the image of the scene down there—Elza and Tarrano talking. But could not hear the words—those were denied us. We saw the culprit brought in; the punishment with the white-hot wire-lash, and a few moments later Elza was with us.

During the hours which followed, we made no attempt to escape. Such an effort would have been absurd. The current controls were outside, beyond our reach. Visibly, we were free, with open, unbarred arches and casements. But to pass through one of them, the barring current struck you like a wall, with darting sparks when it was touched. As Wolfgar had said, we had access to the upper balcony; the waist-high rail there, with its needle-points of electrodes, sent up a visible stream of the Nth Electrons—a dull glow by daylight; at night a riot of colors and snapping sparks mounting upward.

We stood motionless, breathless. A moment; then into the room came Wolfgar. He did not speak. Advancing close to us as we stood transfixed, he jerked an instrument from his belt. It whirred and hummed in his hand. The room around us went black—a barrage of blackness and silence, with ourselves and Wolfgar in a pale glow standing within it as in a cylinder. The isolation-barrage.

Through this barrage an inner vista of the city was visible; towers, arcades, landing-stages and spider bridges a hundred feet or so above us; the lower levels beneath, and through a canyon of walls we could just make out a corner of the ground-plaza, with its trees and beds of flowers.

A queerly flat little city—tropical with banana trees and vivid foliage in every corner plot of the viaducts. At night it was beautiful with its romantic spreading lights of soft rose and violet tubes, and there was a fair patch of open sky above us—a deep purple at night, star-strewn.

Under other circumstances our imprisonment would not have been irksome. But

But now, if we were watched, we could not help it; we would have to take the chance. The figure of the girl showed plainly down there through the other casement. And again, with slow-moving white arms she began to semaphore.

these hours, most critical of any of history for the nations of Earth, Venus and Mars, unfolded their momentous events while we were forced there to helpless idleness. All sending apparatus of our instrument room was permanently disconnected. But the news came in to us from a hundred sources—rolled out for us in the announcers' droning words; printed for permanent record upon the tapes and visible images of it all constantly were flashing upon the mirrors.

We spent hours in that instrument room—one or the other of us was almost always there. Save that we were ourselves isolated from communication, we were in touch with everything. A whim of this Tarrano; perhaps a strain of vanity that Elza should see and hear of these events.

So much had occurred already during those hours of our trip over the Polar ocean and back that we scarce could fathom it. But gradually we pieced it together. Underlying it all, Tarrano's dream of Universal Conquest was plain. In the Venus Cold Country he had started his wide-flung plans. Years of planning, with plans maturing, slowly, secretly and bursting just now like a spreading ray-bomb upon the three worlds at once.

In Venus, the Cold Country had conquered its governing Central State. Tarrano's army there was in full control. The Helio Station in the Great City was now reinstated. The Tarrano officials had already set up their new government. With notification to the Earth and Mars that they demanded recognition, they were sending the usual routine helio dispatches and reports, quite as though nothing had occurred. The mails would proceed as before, they announced; the one due to leave just this afternoon for the Earth was off on time.

It was all very clever propaganda for our Earth-public consumption. Tarrano—who was visiting our Earth at present, they said—had been chosen Master of Venus. His government desired Earth's official recognition, and asked for our proclamation of friendliness in answer to their own. The present Ambassadors of the Venus Central State to the Earth—there were three of them, one each in Great-London, Tokyohama and Mombozo—this new government requested that we send them back to the Great City as prisoners of the Tarrano forces. Other Ambassadors, representing the new government, would be sent to the Earth.

All this occurred during the first few hours of our imprisonment in the tower. And during the day previous, at 7 P. M. this night—70° West Meridian Time—the Governments of our Earth met in Triple Con-

(Continued on page 558)

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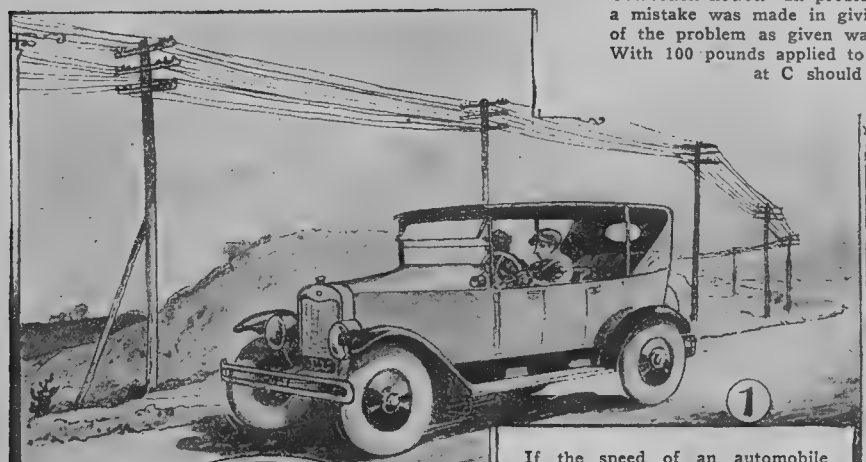
Scientific Problems and Puzzles

By ERNEST K. CHAPIN

Correction notice. In problem No. 5, published under this head in the September issue, a mistake was made in giving the answer to the problem of the levers. The solution of the problem as given was correct up to the calculations involving the third lever. With 100 pounds applied to B on this lever, the correct weight that would balance it at C should be 33 1/3rd pounds instead of 25 pounds.



1

If the speed of an automobile equals the number of telegraph poles passed in 90 seconds, how far apart are the poles?

3

As water constantly drips from a faucet into a pan of water, a note of distinct pitch is heard. It is musical in character. Can you see any reason for such a note being produced?

2

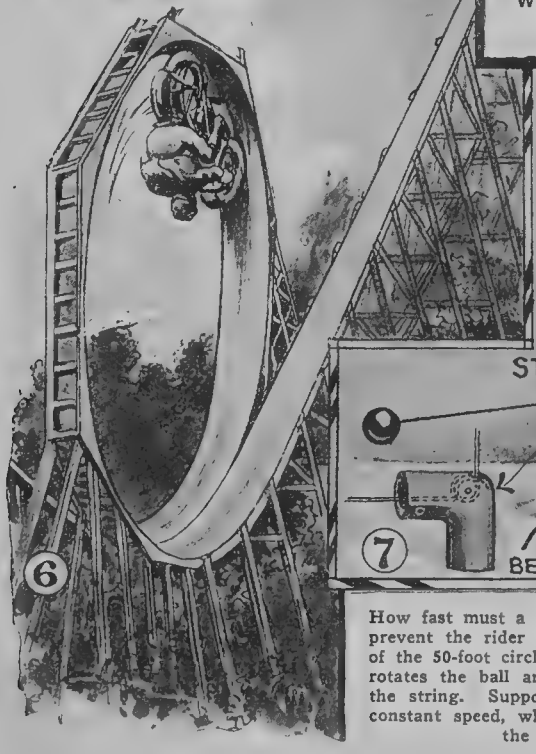
Blow-outs are more frequent in hot weather than in cold weather. Is this increase due to an increase in pressure that results with the rise in temperature of the air in the tires?

4

What produces the hammering sound often heard in a steam radiator?

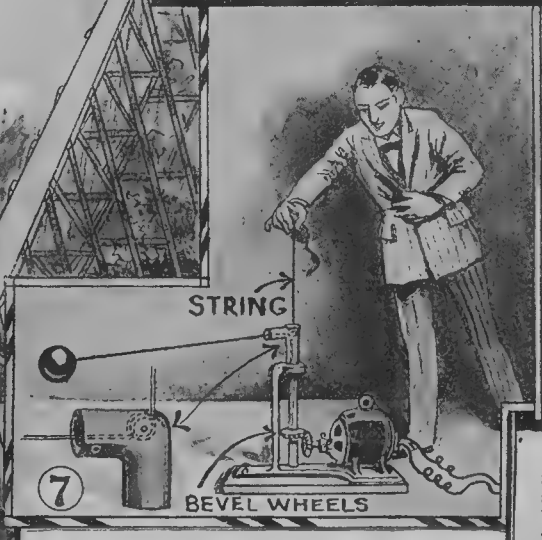
5

Directions accompanying cleaning fluids for clothes always tell us to rub the cleaner toward the spot but not across it. Why should this procedure be necessary?



6

How fast must a motorcycle in Fig. 6 go to prevent the rider from falling off at the top of the 50-foot circle? The machine in Fig. 7 rotates the ball and can lengthen or shorten the string. Suppose the motor rotates at a constant speed, what effect would shortening the string have?

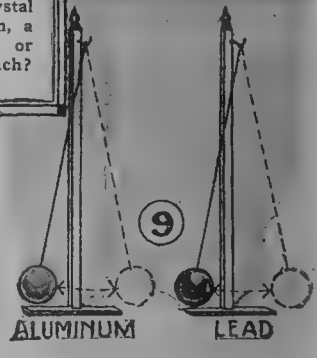


7

8

Is the distance between the atoms in a crystal of salt a thousandth, a hundred-thousandth, or a millionth of an inch?

Two pendulums are identical in all respects except that the bobs are of different material and weight. Which pendulum, if either, will swing faster?



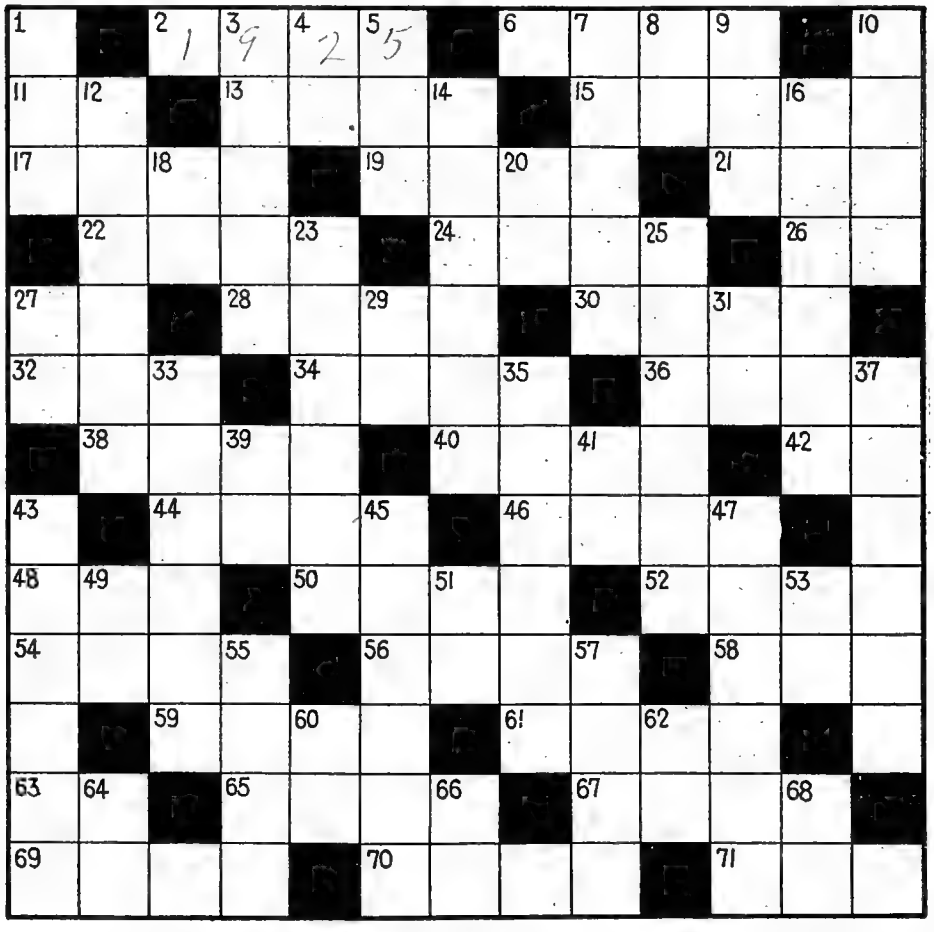
9

(Answers to these problems given on page 585)

Google

Mathematical Cross-Number Puzzle

Here you are, cross-word puzzle fans, here is a puzzle that will tax your ingenuity to the utmost. The answers are given on page 587 but for your own sake do not refer to them until you have finished the puzzle or exhausted your fund of information. This puzzle is radically different from the usual type in which letters are inserted in blank space to form words. In this one, definitions are given which, by dint of hard thinking, can be worked out into numerals which numerals are inserted in the correct order in the blank spaces and which will line up both vertically and horizontally in the same way as the letters do in the ordinary cross-word puzzle. The first answer, 2 horizontal, is 1925. We have named this new brain teaser "Cross-Number Puzzle."



HORIZONTAL

2—The current Year of Grace.
6—One perch; decimal after the second figure.
11—One more than a saw-horse with a C following it.
13—Take the number of cubic feet required to fill a lot 60 feet by 80 feet, 1.6 feet deep; then add the number of cubic feet in a cubic yard.
15—Add 117 to the number of miles in the earth's equatorial circumference. (The last figure is 9.)
17—Take the abbreviation for the State of Maryland and add seven thousand to it.
19—An M, a C, an X, and a personal pronoun of the first person singular.
21—Boiling point of water, Centigrade.
22—Inches in a meter; decimal after the second figure.
24—The Year of Our Lord it will be MCX years from now.
26—The cube of 4.562; nearest whole number.
27—The age of President Coolidge.
28—Add two to the product obtained by multiplying together the digits 34568.
30—The current year according to the Byzantine calendar.
32—The prefix denoting "doubly," "twice" or "two fold."
34—The year, according to the Jewish calendar, beginning September 18, 1925.
36—The centennial year of this country.
38—The millenial year of the discovery of America.
40—The year when Napoleon met his Waterloo.
42—Twice the number of shillings in a British guinea.
44—A couple of M's, and then add three.
46—The current year according to the Mohammedan calendar.
48—The period of time, usually expressed as "The ——— Days," between Napoleon's return from Elba and Waterloo.
50—Fifty-two feet more than a nautical mile in feet.
52—The square yards in an "are"; decimal just before the last figure.
54—The year before the twentieth century started.
56—Twenty-eight sixty-fourths decimally expressed.
58—The number of days from any given day in February (not leap year) to the same day in June.
59—The number of feet in 1110 and 1/6th fathoms.
61—A millennium.
63—The number of the Commandments.
65—47.328 cords expressed in cubic feet; nearest whole number.
67—Twelve feet less than a quarter of a mile.
69—"That was the year when Lisbon town,
Saw the earth open and gulp her down."
(Apologies to Dr. Holmes.)
70—Fifty-seven minutes expressed in decimals of a degree; decimal in front of the first figure.
71—Boiling point of water by the Centigrade thermometer.

VERTICAL

1—Inches in a rod.
3—Square three hundred and eleven and a half; nearest whole number.
4—The number of cubic feet in a cubic yard.
5—Divide the present Year of Our Lord by 3.85; then add one.
7—One kilometer in miles; decimal in front of the first figure.
8—Square root of 3025.
9—A cubic decimeter expressed in terms of a cubic meter; decimal in front of the first figure.
10—Twenty years ago.
12—Multiply the number of inches in a mile by 2.4; then add 1238.
14—Add 8312 to the cube of 89.
16—Eighty-seven less than the square of three hundred and thirty-one.
18—The square root of .0081; decimal in front of the first figure.
20—The number of the digits for which we are indebted to Arabia.
23—Multiply together the digits 988973; then multiply the product by 7.213; and subtract 30 from the result.
25—45128 and 5/12ths pounds in Troy ounces.
27—Four more than the abbreviation for Long Island.
29—The number of cubic feet in three and five twenty-sevenths cubic yards.
31—Ten more than two stone.
33—Subtract 9104 from seven times the number of minutes in a circle.
35—Take 9929 from the number of acres in 30 townships.
37—The number of minutes in a year (not leap year).
39—An hour and a half in minutes.
41—The number of years it will take a dollar at 5 per cent. compound interest to be worth $1.88.
43—Six egos in a row.
45—Abbreviation for the Philippine Islands; decimal after the first figure.
47—Add 5777 to the cube of 74.
49—The square root of .0064; decimal in front of the first figure.
51—Two poles.
53—The number of days from any given day in June to the same day in September.
55—Subtract seven from the number of sheets of paper in 403 quires.
57—Take the number of cubic inches in three cubic feet and subtract 174 from it.
60—Ten times the standard abbreviation for an intransitive verb.
62—Simple interest on $100 at 4 per cent. for three days; nearest cent-decimal before the first figure.
64—Simple interest on $100 at 5 per cent. for 5 days; nearest cent—decimal before the first figure.
66—Fifty-one minutes expressed in decimals of a degree; decimal before the first figure.
68—An L and three saw-horses.

(*Answers on page* 587)

To Keep Garden Soil Moist

To keep garden soil moist, says Dr. Karl Schultze, disks of newspaper were placed around the various plants as shown at the left immediately after the soil was watered in the usual manner. A slot was cut in the disks to facilitate placing them around the plant stem. The slot should be made to point away from the wind and often a little soil placed on the side toward the wind will aid in preventing the disks from tearing.—Die Umschau.

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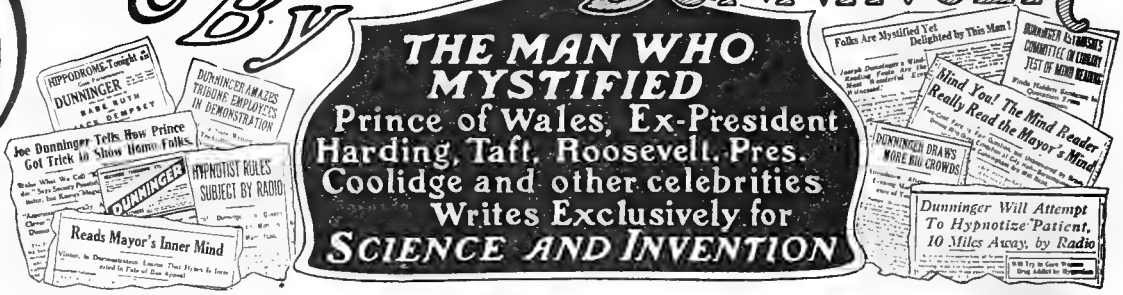
MAGIC By "DUNNINGER"

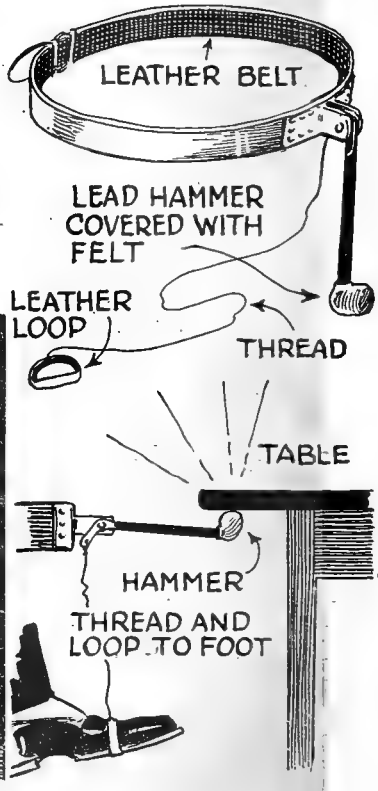
THE MAN WHO MYSTIFIED Prince of Wales, Ex-President Harding, Taft, Roosevelt, Pres. Coolidge and other celebrities Writes Exclusively for SCIENCE AND INVENTION

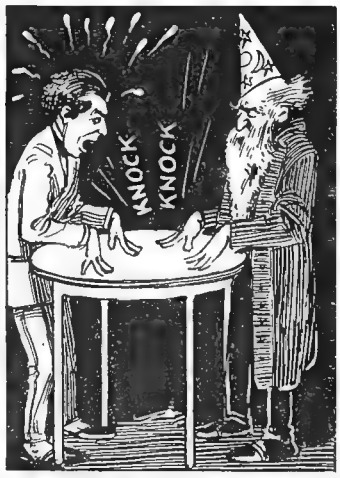

HIPPODROME-Tonight
DUNNINGER
BABE RUTH
JACK DEMPSEY
DUNNINGER AMAZES TRIBUNE EMPLOYEES IN DEMONSTRATION
Joe Dunninger Tells How Prince Got Trick to Show Home Folks
DUNNINGER
HYPNOTIST ROLES SUBJECT BY RADIO
Reads Mayor's Inner Mind
Folks Are Mystified Yet Delighted by This Man!
DUNNINGER ASTONISHES COMMITTEE OF LIBRARY JEST OF MIND READING
Mind You! The Mind Reader Really Read the Mayor's Mind
DUNNINGER DRAWS MORE BIG CROWDS
Dunninger Will Attempt To Hypnotize Patient, 10 Miles Away, by Radio

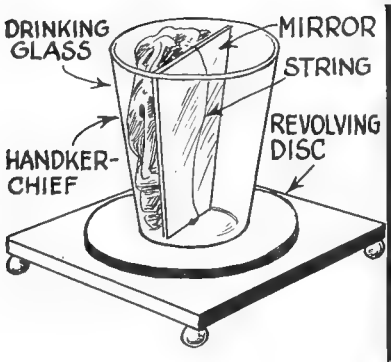
NO. 31 OF A SERIES

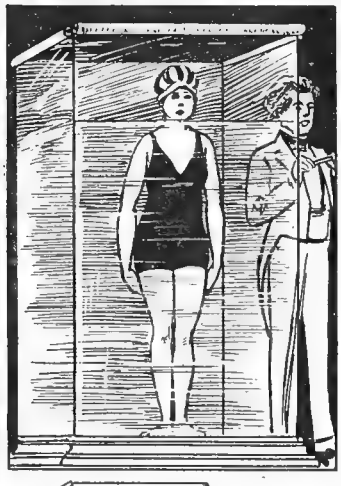
The performer attired in an Oriental costume makes several passes over a large celluloid ball. Then, pointing his finger at the ball, the ball spins up into the air. He continues to point his finger at the ball, causing it to float before him as he walks among the audience. The secret lies in the compressed air harness hooked to his back, the hose from which terminates at his sleeve.

Mysterious table rappings can be easily produced by employing the harness shown here. A lead hammer secured to the harness as illustrated is operated by the foot of the performer. The beauty of this trick is that the spirit raps may be produced at anyone's home, using any table and the performer need not be seated. The harness is turned around on the body when not in use.

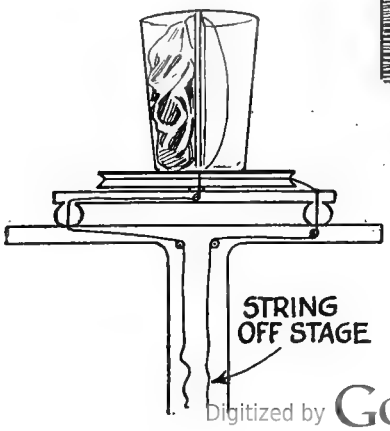




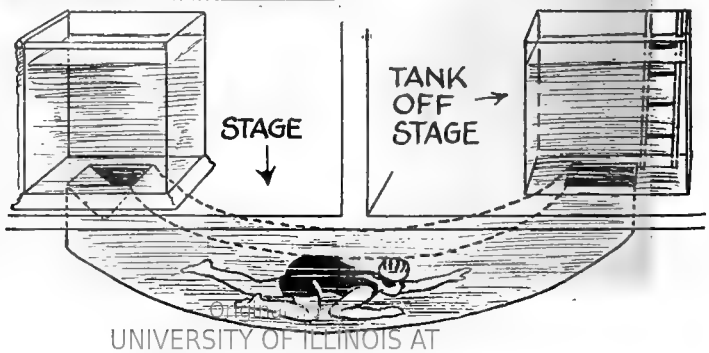




The performer demonstrates a remarkable "disappearing lady" act. A girl in a swimming suit leaps into a large tank made entirely of glass which contains enough water to come up to her neck. Spectators are invited from the audience to surround the tank and make sure that she cannot escape through the back or over the top of the tank. Curtains are now drawn, a shot is fired, the curtains are raised and the girl is gone. The details of the system are illustrated below.



A silk handkerchief is made to disappear from a glass and to reappear therein in the manner here shown. The glass contains a mirror partition. The silk is placed in front of the mirror. Pulling the string attached to the silk piece causes the kerchief to leap into the other half of the glass. Pulling the other string attached to the revolving disk, turns the glass, bringing the kerchief into view again.



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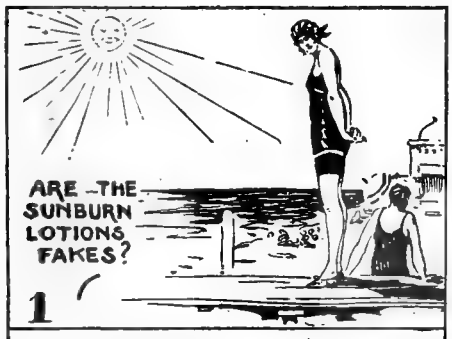
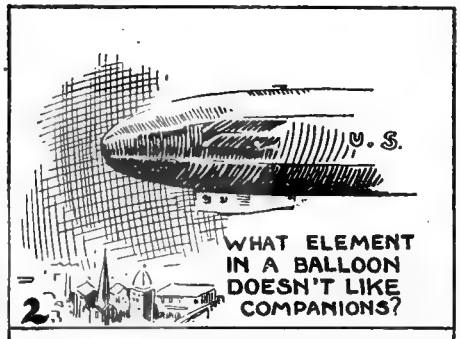
Everyday Chemistry

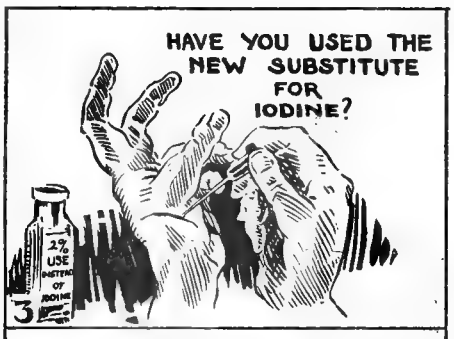
By RAYMOND B. WAILES



No, because they contain an organic chemical, napthol sulphonic acid, which screens out the ultra-violet rays of sunlight.

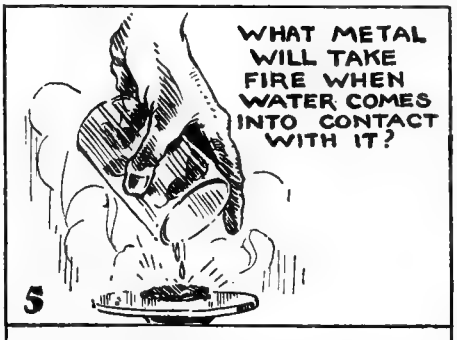


Helium, the non-inflammable gas used in dirigibles, has never been known to combine chemically with other elements.

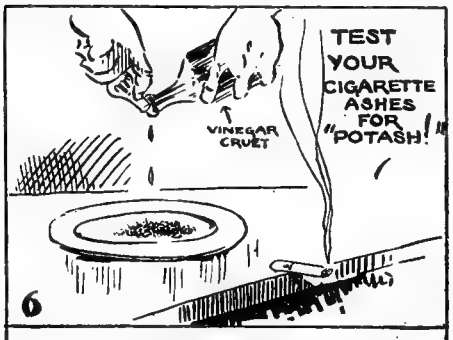


Forms of red dye have recently been found to act as highly efficient germicides. Mercurochrome is an example.

Because red rubber contains antimony sulphide which makes the material able to withstand rather high temperatures.



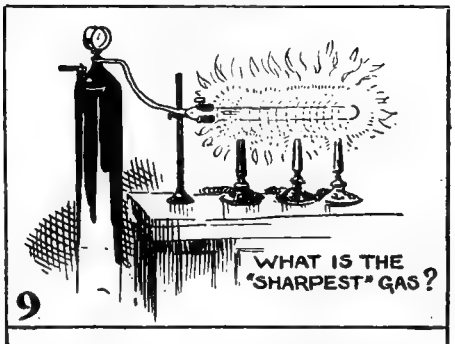
Potassium when in contact with water liberates hydrogen gas so violently that the hydrogen ignites and possibly the metal burns also.



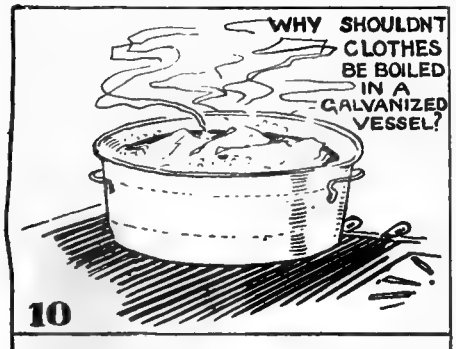
Vinegar when added to cigar or cigarette ashes produces bubbles of gas which prove in a measure that potassium carbonate is present.

A "universal" poison antidote is: Iron sulphate, 4 ounces; magnesia, 2 ounces; animal charcoal, 1 ounce; and water, 20 ounces.

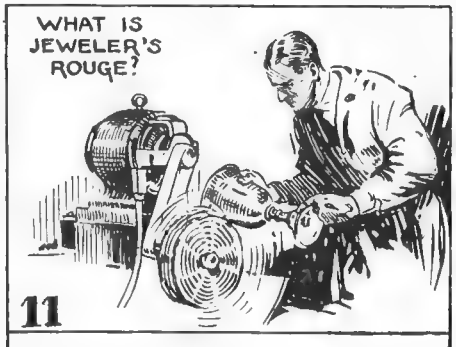
The sizzling that is heard when water is heated just before it boils is due to the escape of the air dissolved in the water.



Hydrogen gas will pass readily through the walls of a red hot platinum tube, leaving the platinum walls unaffected.



Because soapy water is alkaline and therefore will tend to destroy the zinc coating, leaving the iron exposed to rust.



This is nothing more than iron rust or ferric oxide almost molecularly pulverized and it is used for polishing jewelry.

No. Two sheets of glass are combined with a sheet of celluloid between them, giving resiliency to withstand sharp blows.

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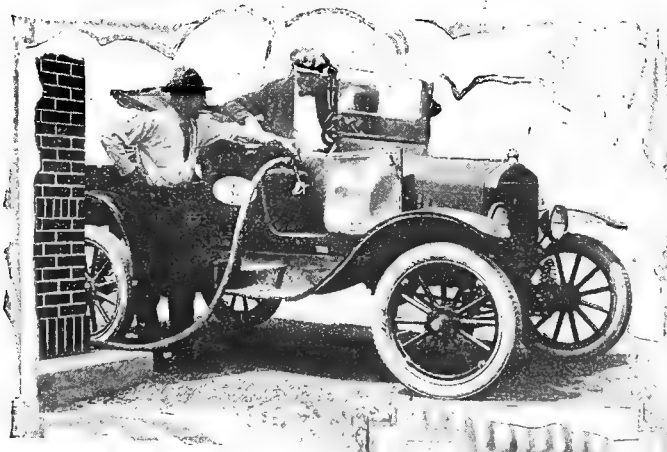
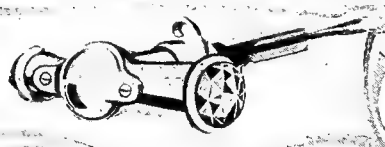
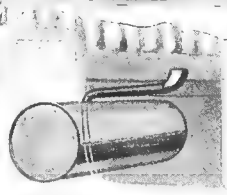
The Latest Auto Devices

CAR VENTILATOR—Above is shown a new car ventilator. It will give fresh air yet keep the rain out. Made of steel with enamel finish they are easily installed and do not interfere with the windows.
—C. G. Percival.

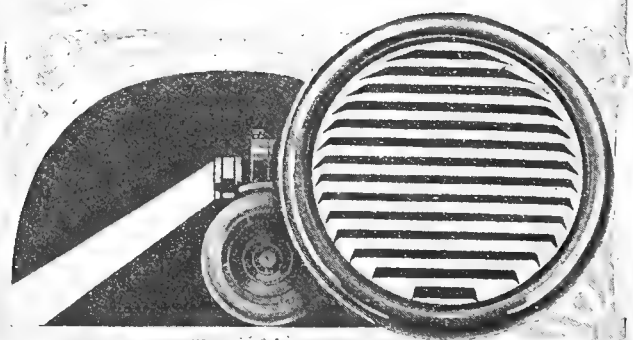




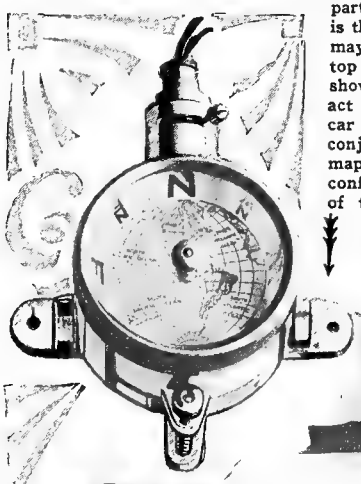


GAS TANK FILLER—A simple device has been invented for the gasoline tank on a Ford. This appliance is attached to the ordinary gasoline tank and the gasoline may be poured in while the driver remains in the front seat. A diagram of the improvised funnel-like device is illustrated in the drawing at the right.
—John B. Roswick.

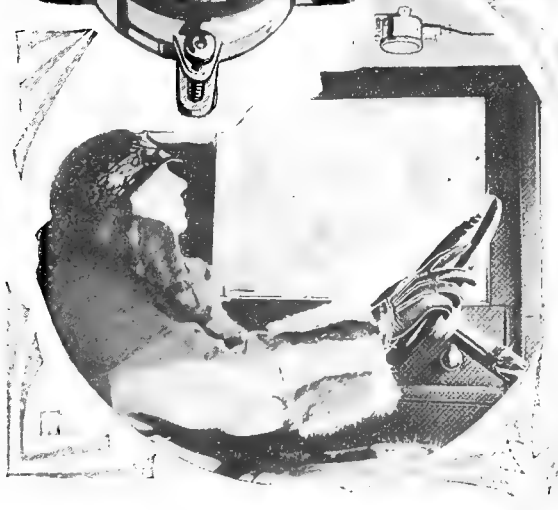
HANDLE LIGHT—We show above a new type of handle light for automobiles which can be installed in a few minutes. It is substituted for the door handle and is a parking light as well. The lamp is controlled from the dash.—C. G. Percival.

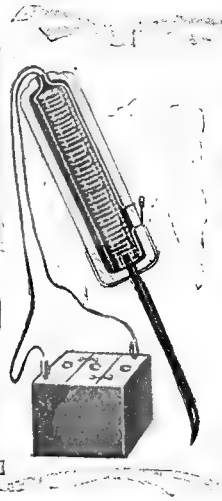


AUTO COMPASS—Something entirely new for the convenience and comfort of the auto driver and particularly for the tourist is the auto compass which may be attached to the top of any closed car to show at a glance the exact direction in which the car is moving. Used in conjunction with the road map, it eliminates any confusion in the mind of the driver as to the direction in which the route lies.
—C. G. Percival.



HEAD LIGHT GLARE PREVENTER—The device illustrated above may be employed on automobiles even though new types of lenses are not being used. The construction of metal causes all the light to be shot down upon the road and one need not change from bright to dim lights as these shields protect the other motorists and pedestrians.





SPARK PLUG WRENCH — This wrench has a handle connected to the socket by a swivel. One can swing instantly from a horizontal position to vertical. —A. P. Child.

MAGNETIC PICK-UP—A long rod, which can be safely bent into any shape and a magnetizing device controlled by a thumb switch, the coil of which is connected to the storage battery of the automobile, forms this device. It can pick up nuts and bolts from places hard to reach with the hands.
—Allen P. Child.

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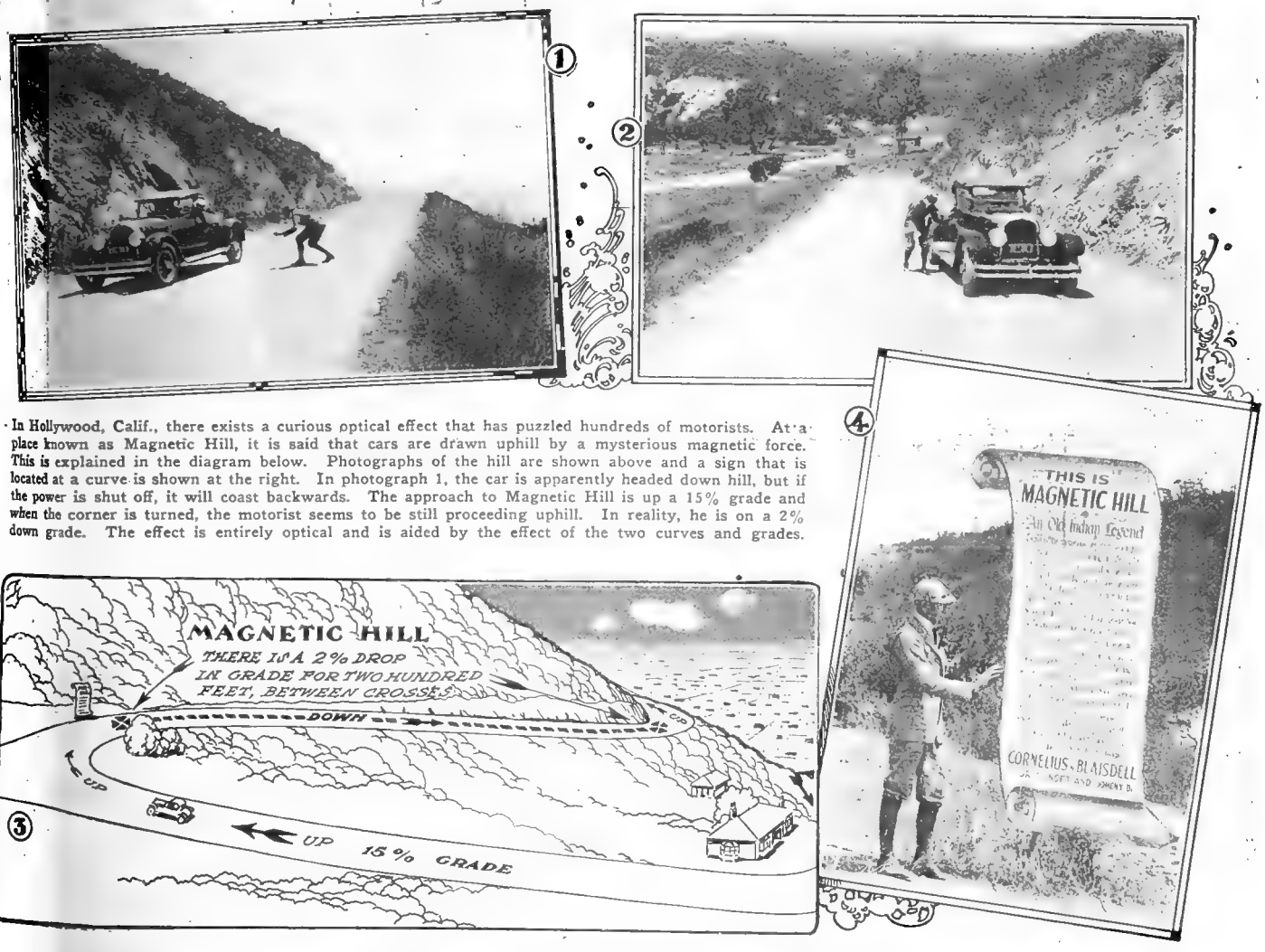
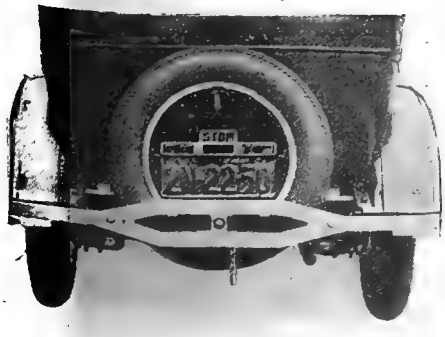
California's "Magnetic Hill" A Myth

By EDWIN SCHALLERT



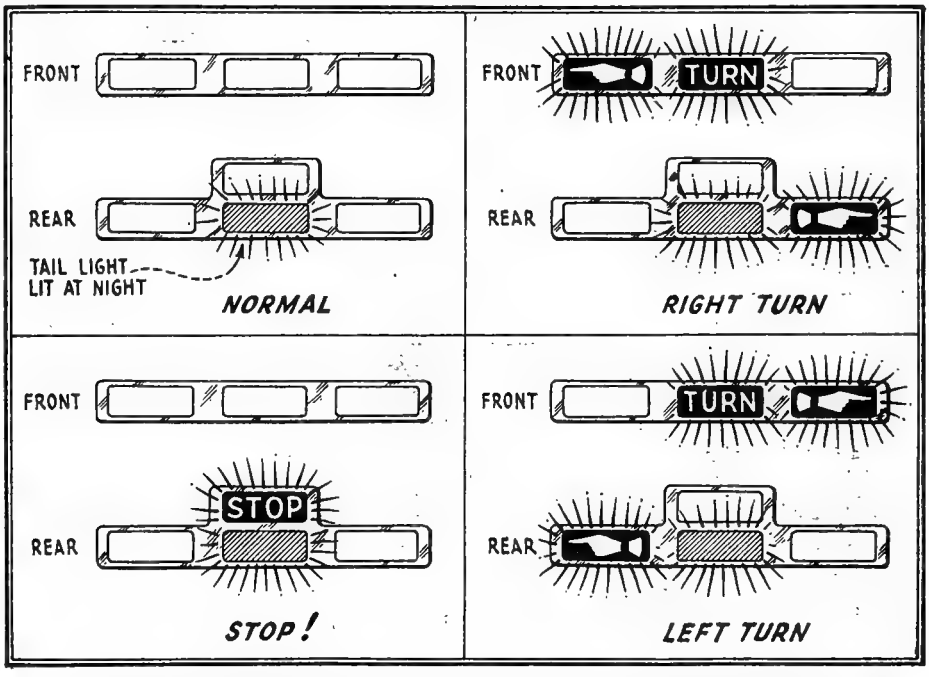
In Hollywood, Calif., there exists a curious optical effect that has puzzled hundreds of motorists. At a place known as Magnetic Hill, it is said that cars are drawn uphill by a mysterious magnetic force. This is explained in the diagram below. Photographs of the hill are shown above and a sign that is located at a curve is shown at the right. In photograph 1, the car is apparently headed down hill, but if the power is shut off, it will coast backwards. The approach to Magnetic Hill is up a 15% grade and when the corner is turned, the motorist seems to be still proceeding uphill. In reality, he is on a 2% down grade. The effect is entirely optical and is aided by the effect of the two curves and grades.

Auto "Stop" and "Turn" Signal



Rear view of signal.

Front view of signal.



A new type of stop, right turn and left turn signal combined with a tail light has recently appeared on the market. It is operated by a manual control located at a convenient position on the dash-board of the car and in proximity to the switch, by means of which the driver dims his lights. The diagrams above show the appearance of the signals when in action. One is mounted on the front and one on the rear of the car.

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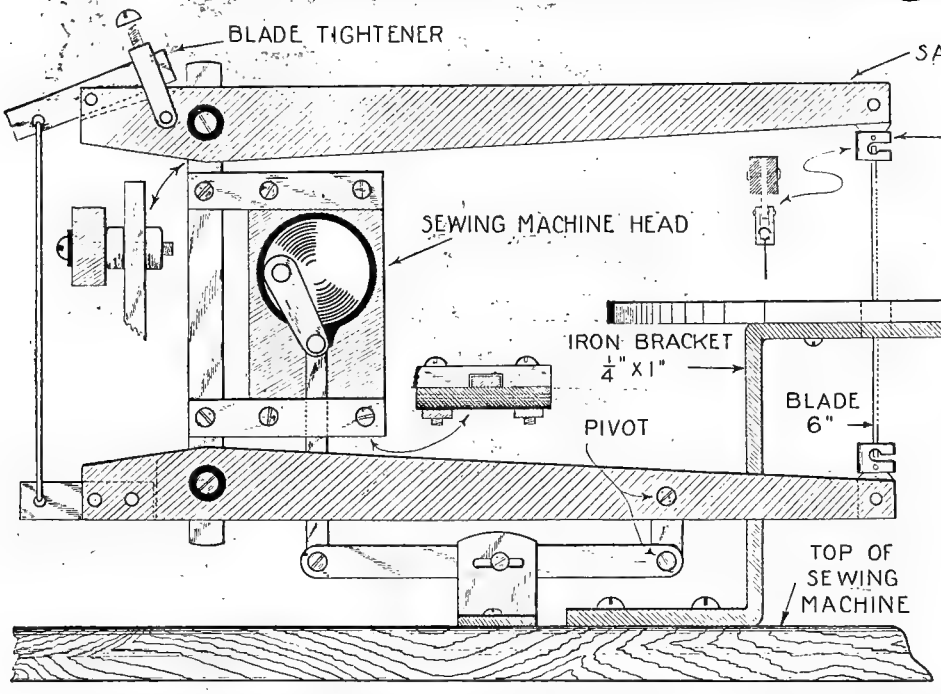
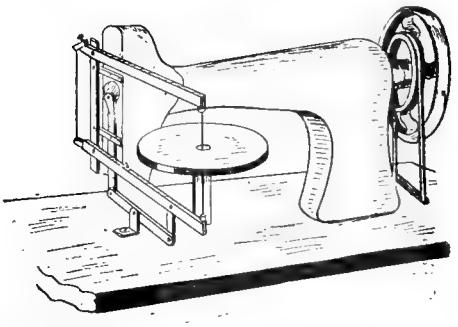
THE CONSTRUCTOR

Scroll Saw from Sewing Machine

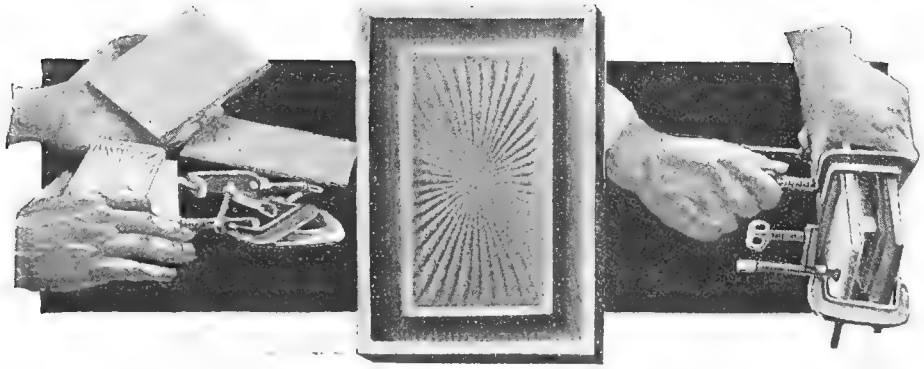


A few pieces of scrap iron and strips of hard wood will enable anyone to build a handy and serviceable foot-power scroll saw, if they follow the drawings given herewith.



The plate covering the left end of the sewing machine arm is removed, exposing the crank stud to which the short arm shown is attached. The recriprocating motion thus obtained is transferred through the various arms to the saw blade. The latter is of the 6-inch-long type and can be obtained at any hardware store. Tension is applied to the blade by means of the adjusting screw shown. The table may be a disk of wood or steel, according to which is easiest to obtain. The iron bracket supporting it must be rigid in order to insure the production of good work on the finished machine.

—Harold Jackson, Rep. No. 2903.



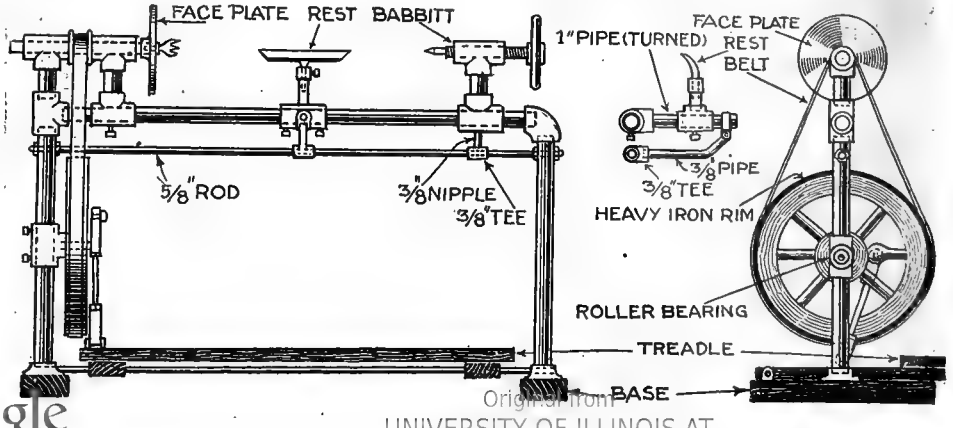
Imitating Carved Wood

Imitations of carved wood can be used for panels ornamenting small doors, cupboards, etc. The material used is wall board or heavy cardboard, although it is possible to glue several pieces of thin cardboard together to obtain the required thickness. A mold is necessary, consisting of heavy glass or metal in which the design has been pressed or stamped. Soak the material to be used in water and place the mold on the surface. Place heavy boards on either side of this assembly and clamp tightly together with several clamps. Leave over night, and in the morning the design will be found pressed into the cardboard. —Dr. Ernest Bade.

Lathe

With a little ingenuity and patience, anyone handy with tools can produce a foot-power wood turning lathe that will give excellent results. The materials used consist mainly of pipes, pipe fittings and iron rods. Wood strips are used for the treadle and the mounting bases. The wheel from which the belt transmits the power to the face plate may be an old wagon wheel equipped with a heavy iron rim so as to give a fly-wheel effect. The bearings consist of pipe tees filled with babbitt. The latter metal may also be used for holding the adjustable tail-stock screw in position. The details of the tool rest are shown. Here again pipe fittings are used in the construction. The tool rest may be purchased or made as desired.

—Author please send address.



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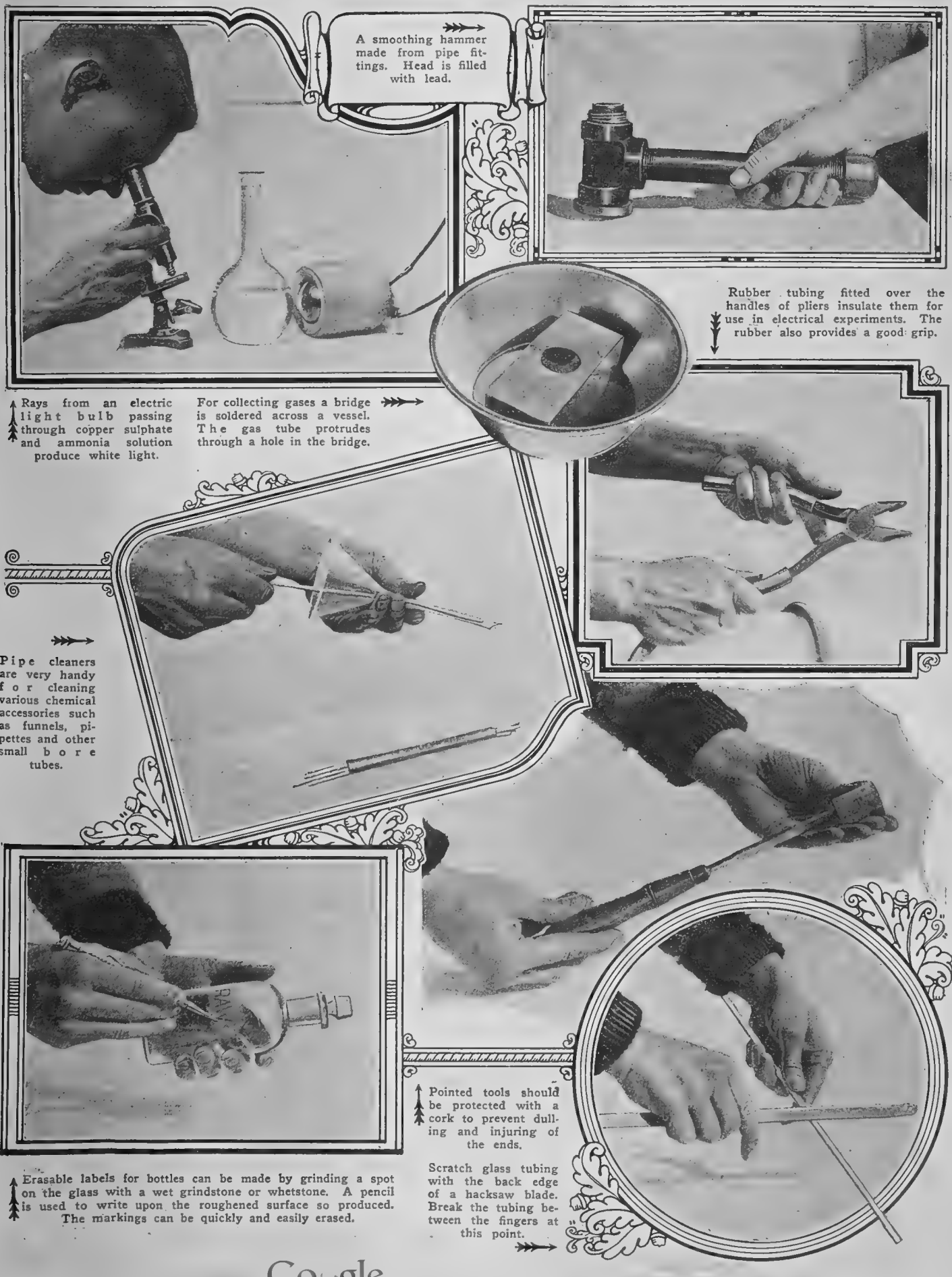
Helpful Laboratory Hints

By RAYMOND B. WAILES



A smoothing hammer made from pipe fittings. Head is filled with lead.

Rubber tubing fitted over the handles of pliers insulate them for use in electrical experiments. The rubber also provides a good grip.

Rays from an electric light bulb passing through copper sulphate and ammonia solution produce white light.

For collecting gases a bridge is soldered across a vessel. The gas tube protrudes through a hole in the bridge.

Pipe cleaners are very handy for cleaning various chemical accessories such as funnels, pipettes and other small bore tubes.

Erasable labels for bottles can be made by grinding a spot on the glass with a wet grindstone or whetstone. A pencil is used to write upon the roughened surface so produced. The markings can be quickly and easily erased.

Pointed tools should be protected with a cork to prevent dulling and injuring of the ends.

Scratch glass tubing with the back edge of a hacksaw blade. Break the tubing between the fingers at this point.

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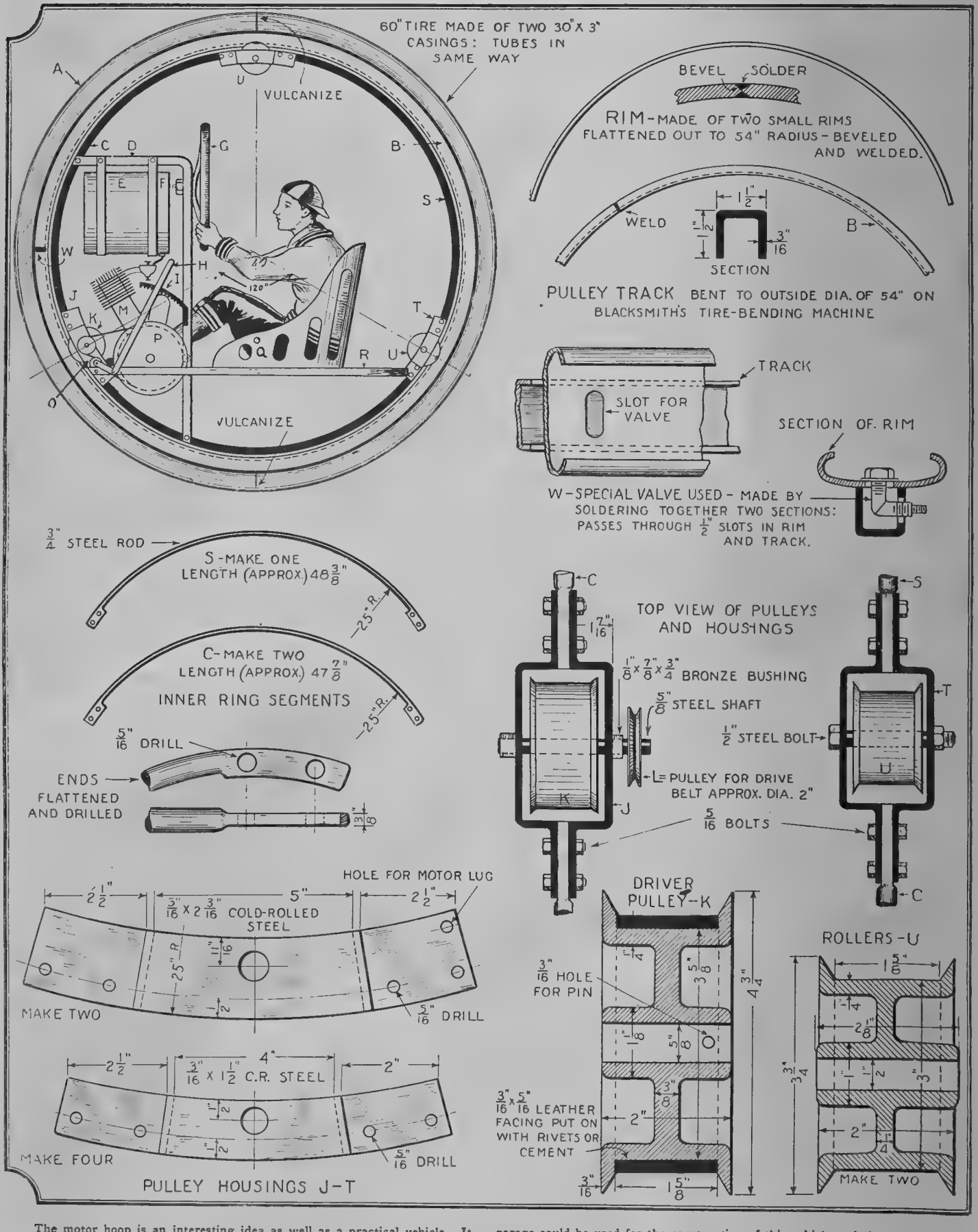
Building the Motor Hoop

By JOHN GALEN BARBER



The motor hoop is an interesting idea as well as a practical vehicle. It will give efficient, economical service and is capable of traveling at a speed of approximately 35 miles an hour or more. The device has been so designed that those parts generally found in a small service station or garage could be used for the construction of this vehicle and the mechanical ability for building it is usually available locally. There is no doubt but that it would attract considerable attention. It will ride smoothly and can negotiate bad roads with ease.

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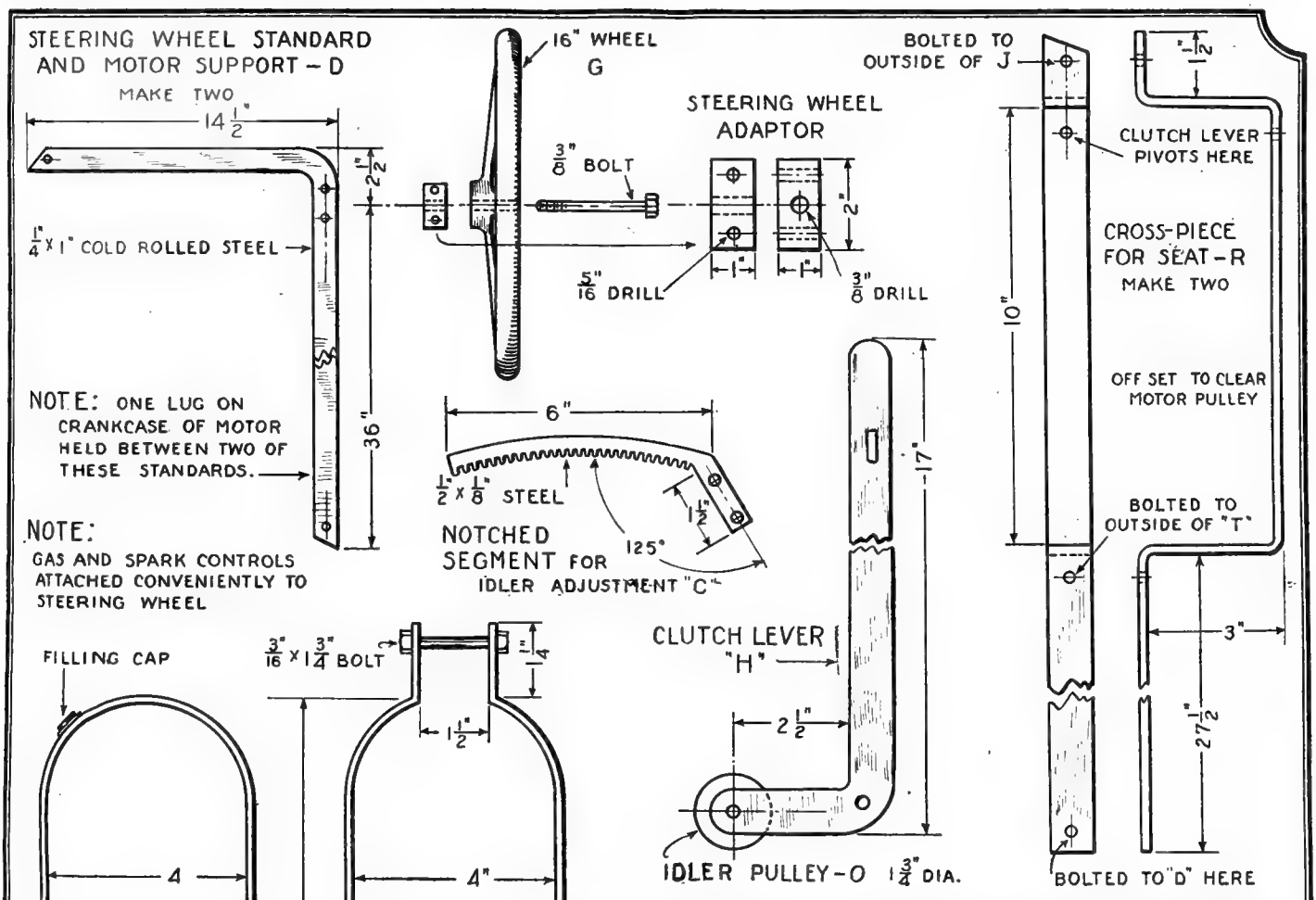
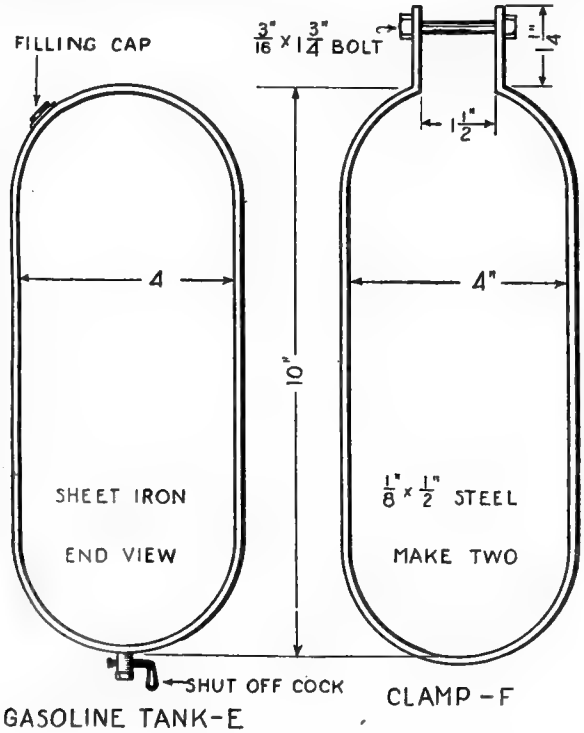
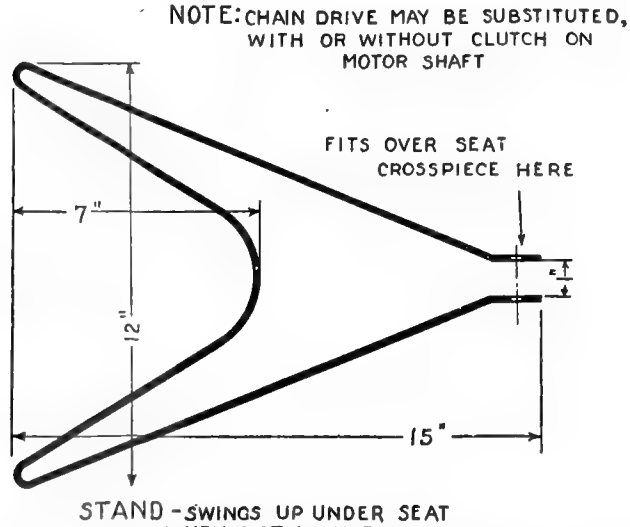
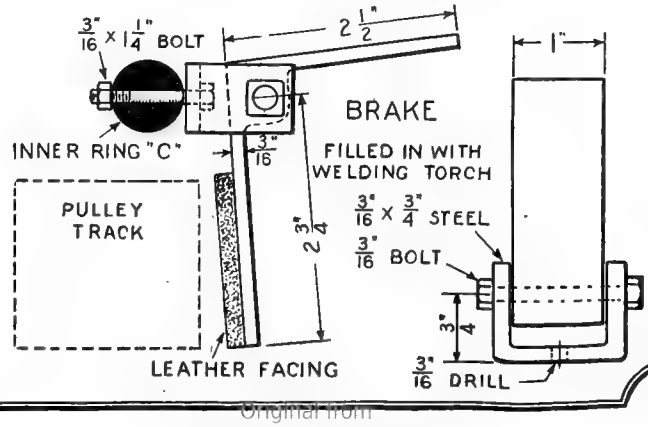




ALL the parts of the motor hoop are lettered, and the detailed drawings for each part are given and their association can easily be found by reason of the corresponding letters. The rim of the motor hoop is made of two standard rims, cut and welded together. The channelled iron track is bent on a blacksmith's tire-bending machine, and the brake parts are welded together. The tire with which this device is equipped is made by vulcanizing two standard 30 by 3 inch tires. The inner ring to which the motor and accessories are attached is bent from round bar steel. These sizes of course may vary if the individual attempting to use the motor wheel is of unusual physical proportions. The outer tire and rim revolve about the inner ring on three rollers, one of which is driven by the motor. Power from the latter is transmitted from the 9-inch pulley on its shaft, to a 2-inch pulley, thence to the shaft drive roller, and finally to the big outer tire. A chain drive may be used if desired, but in this construction a belt was used and a clutch added as illustrated. Spark and gas controls are attached to the steering wheel, which is a dummy and serves merely as a convenient grip. Steering is accomplished by shifting the balance of the machine causing it to lean in the direction in which it is desired to turn, as in the case of the child's toy hoop. Ordinary braking is done by reaction against the motor compression. The foot brake is used for emergency or quick stops. The operator prevents the machine from falling by extending his foot on either side, and when the machine is not to be used for a while, the operator lets down the stand, normally folded under the seat, where it is held by a spring clip.


NOTE: CHAIN DRIVE MAY BE SUBSTITUTED, WITH OR WITHOUT CLUTCH ON MOTOR SHAFT
FITS OVER SEAT CROSSPIECE HERE
7"
12"
15"
STAND – SWINGS UP UNDER SEAT WHEN NOT IN USE

NOTE SEAT IS AIRPLANE, AUTO-BUCKET, OR MOTORCYCLE SEAT



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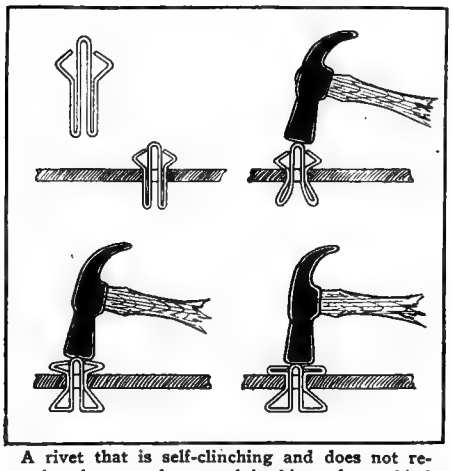
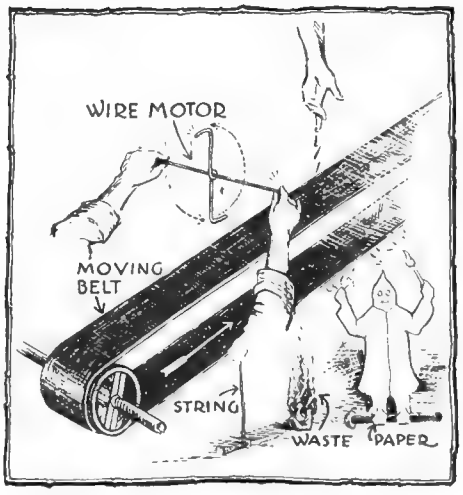
HOW TO MAKE IT

New Rivet



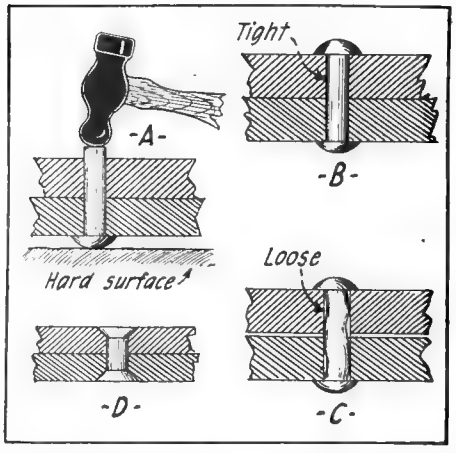
A rivet that is self-clinching and does not require the use of a metal backing of any kind is shown in use above. The illustration in the upper left-hand corner shows the rivet ready for use. It may be used for holding sheets of metal together and also may be employed in place of toggle screws. For fastening together the corners of steel stock bins, this rivet is most available. Only a hammer is needed to apply it. The various steps are shown clearly above. The rivet is placed in the hole, and is then hit with a hammer. For simplicity, our drawings show only one sheet of metal, but the rivet is to be used for fastening together two or more sheets. With one blow of the hammer, the rivet is changed from the shape shown in the first of the progressive diagrams to that shown in the last of them.—Walter T. Markowski, Rep. No. 192.

Static Generator



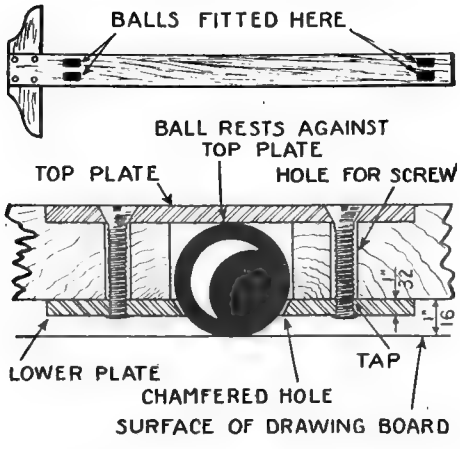
In shops or factories, where there are machines driven by leather belts, many interesting experiments in static electricity may be performed. A wire motor that will revolve briskly is made from two pieces of copper wire, one used as the shaft and the other, bent at the ends and center as shown, is used as the rotor. Bits of string or waste will stand perpendicular if held down with small weights. Grotesque paper figures will perform in the same manner. Bluish static discharges can be seen at the points indicated in the above drawing and are particularly spectacular in the dark. Sparks can often be drawn to the end of the finger, particularly on dry days. —H. S. Fox, Rep. No. 5439.

Riveting Hints



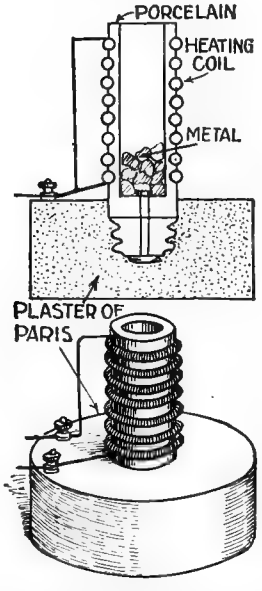
Even though rivets are most ordinary accessories in metal working, still it is surprising to note how often they are incorrectly applied. The holes that are drilled for rivets should always be just large enough for the rivet to slide through as at A and B. If the hole is too large as at C and the rivet is placed under any strain, it will soon bend out of shape and probably shear off. In any event, the joint will not be a tight one. When using rivets in wood, the drilled hole should be slightly smaller than the rivet whereupon the latter should be driven in. Of course, the correct hammer to use in riveting is the type shown at A. The end of the rivet should be smoothly turned over until it assumes the same appearance as the opposite end. Rivets set flush as at D should also be tight in the holes. —Pan, Rep. No. 6535.

Tee Square



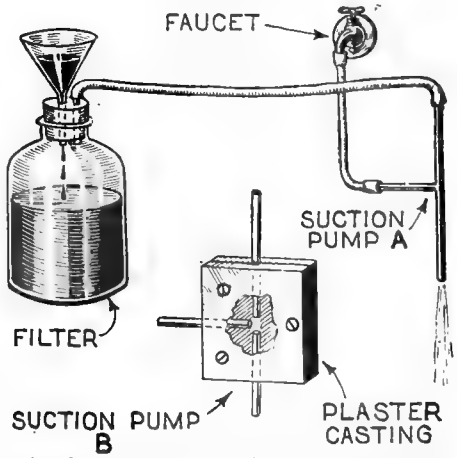
Fitted with the ball bearings shown above, a tee square will travel over the whole of the drawing board with the greatest ease, no matter how long or heavy the tee square may be. For large tee squares, four ball bearings should be used and are placed as shown. Two metal plates are used at each bearing and in one of them a hole is drilled and chamfered. The other plate is set flush with the top of the square and the two are held together by machine screws. This device has another advantage in that it keeps the tee square slightly above the paper and prevents the dirt marks that are often caused by the arm of the square. —C. A. Oldroyd, Rep. No. 4433.

Furnace



A small electric furnace for use in the experimenter's laboratory for melting small quantities of metals may be made from a heating coil of the type used in standard electric reflecting heaters. The coil is mounted in a plaster of paris base and leads are provided as shown. The metal to be melted is placed inside of the porcelain tube and the current turned on. —E. C. Zimmerman.

Air Pump



An air pump that is especially adapted to force filtering may be made by following the directions given above. Two different types are shown at A and B. The first is merely two glass tubes welded together in the form of a T. The water enters the short arm of the T and goes out through one of the long arms. As it does this, it carries bubbles of air from the other arm of the tee with it, creating a partial vacuum. A partial vacuum is therefore created in the receptacle of the filter and the filtering process may be carried to a completion very rapidly. The pump at B is made from three brass or glass tubes and two plaster casts bolted together as shown. —C. A. Oldroyd, Rep. No. 4433.

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Readers Forum

SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 53 Park Place, New York City.

LAVENDER RAYS

Editor, SCIENCE AND INVENTION:

What good do the lavender sun rays give to the human body? If so, is there any way how to separate them in order that they can be used as a medical remedy?

A. STARENGA,
Detroit, Mich.

(You are evidently referring to the ultra violet rays. Ultra violet rays are being used in the hospitals today, and an article on that subject appeared in the May issue of SCIENCE AND INVENTION *Magazine. We would advise that you refer to that issue. The rays may be produced artificially by either a quartz mercury vapor lamp, or by an arc with iron electrodes. These rays do not penetrate ordinary window glass, but readily pass through quartz glass.*—EDITOR.)

S. & I. INDEX

Editor, SCIENCE AND INVENTION:

For some time I have been a subscriber to the magazine SCIENCE AND INVENTION which you publish, and which in my opinion is the best which is published in your country, for its magnificent presentation, its excellent scientific material, and above all, for the original graphic form, by means of which it discloses recent scientific discoveries and many other points of knowledge of interest to its readers. The readers, in this manner, easily retain in memory the published data, without becoming weary, but on the contrary its style attracts them to pages of so interesting a magazine.

So that the interest of this periodical which you publish may be much greater, and above all so that the utility of SCIENCE AND INVENTION can be at the maximum, all that is wanting is an alphabetical index to be published every six months, which will give all the articles which have been published in your magazine. Thus the reader who wants to consult any scientific matter will find without any great trouble, by means of said index, the numbers of SCIENCE AND INVENTION in which are treated the themes sought for.

If you accept my suggestion, then SCIENCE AND INVENTION will be a scientific encyclopedia which can be consulted at any moment by its readers, and the great number of articles of real interest which it publishes in all its numbers will cause it to occupy a high place in the library of any person who is a lover of scientific investigation.

FRANCISCO RUIZ ESCOTO,
Quadalajara, Jal, Mex.

(Publishing an alphabetical index every six months in the magazine would take away a lot of the reading matter, and consequently this idea is not very good. There is a possibility that a complete index will be published at some future date, and will be sold at a nominal charge to those readers of SCIENCE AND INVENTION *Magazine desiring it. The cost will not be more than that expended on publishing the index.*—EDITOR.)

PERPETUAL MOTION

Editor, SCIENCE AND INVENTION:

Some readers of SCIENCE AND INVENTION have been throwing "wet blankets" at me, by intimating to me that I have no definite system or principle for the construction of a gravity operated, perpetual motion machine of more practical value than the thousands of alleged perpetual motion machine models of the past; that I either haven't enough brains to know that I am a deluded mortal, or am seeking notoriety, and if I have a principle for such a machine that is operative, why don't I attempt to win the $5,000 prize that SCIENCE AND INVENTION offers (I will explain my delay on such later). They also ask why I don't organize a company and sell "stock" or shares; that they would like to invest a few hundred dollars in such a promising venture, (some more delightful sarcasm). This is rubbing my fur the wrong way, I am now on my mettle, and I feel like "going over the top." I will either vindicate myself and all bona fide perpetual motion experimenters of the past and present time, or die in the attempt.

I expect to give the readers of SCIENCE AND INVENTION some details of the mechanical leverage principle embodied in my machine in the near future that will be likely to start a new variety of models.

JACOB H. RENNER,
Dover, Ohio

(Many of our readers have submitted perpetual motion ideas to us and have entered "definite systems" into our contest. The difficulty with these is that the systems do not work after the models are built. We shall nevertheless be pleased to receive your model as soon as you have completed the same and if it works, give you enough publicity if you desire to vindicate yourself.—EDITOR.)

SUPER-NATURAL PHENOMENA

Editor, SCIENCE AND INVENTION:

I am writing to you in an endeavor to obtain authentic explanations of various so-called supernatural phenomena, which are accomplinshed by persons claiming to be endowed by occult powers. Although I am a skeptic myself, I am somewhat at a loss when it comes to reasonably explaining the technique employed by these modern charlatans.

As Ingersoll remarked, "Ignorance is satisfied with appearances, with assertions and intelligence demands facts." I aspire to belong in the latter classification which explains my writing this query.

To begin with, I have a friend who is a promising young genius of the coming generation, who claims that there is something to mental telepathy, yet can't say what it is. The reason for his belief in it is remarkable if true, and I have no reason whatsoever to doubt it. My friend attended a performance of a well-known seer at a theater in Portland, and during the demonstration the seer passed among the audience answering various questions. When he came to my friend he asked him for a question. He pulled his card case from a pocket, and asked the mind-reader what was the membership number and the registration number on the lodge card. The mind-reader, with no hesitation, gave them correctly without (presumably) knowing even if there was a card in the case. This happened while my friend was visiting in Portland.

When this same seer came to Seattle he claimed the power of mental vision, and demonstrated it by driving the chief of police's car through crowded streets, while blindfolded and with no one in the seat alongside of him.

There is another performer who claims to be able to free himself after being handcuffed and shackled by anyone. What are the tricks which he employs?

A fourth thing which I have often heard related but have never heard explained is the old-fashioned method of locating water with a willow wand. The mere fact that it will not work with everyone seems to be sufficient proof that it is not all it is claimed to be.

Still another thing which I cannot understand is how a performer after inducing sleep by hypnosis, can drive a spike through a subject's hand and withdraw it without leaving a scar. The subject can also be suspended between two chairs and support a great weight.

I would be very much obliged to you if you would explain all the above in a thorough fashion as most persons doubt everything unless they are fully explained.

K. F. RUDOLPH,
Richmond Highlands, Wash.

(The first effect which you have described, namely, the reading of a card by a so-called mind reader in a theater, is a relatively old trick, this being used by a great many performers on the stage. In accordance with SCIENCE AND INVENTION *Magazine's policy not to disclose those tricks used by regular performers, we cannot describe this system to you. It is, however, fully described in the excellent book, "Magic" by Hopkins.*

A person freeing himself from a pair of handcuffs is a simple matter, and if you purchase a pair of handcuffs from any of the magical supply houses, you will become acquainted with the secret of how the device works.

You are right when you state that there is nothing in the willow wand method of locating water. The claims of the divining rod operators have been time and again explained by scientists.

Hypnosis is a well-known effect. But it is not necessary to induce hypnosis in order to drive a needle or a nail through the hand, or in order to suspend a great weight while being supported between two chairs with the heels on one chair and the neck on another. There are many performers, both on and off the stage, who can accomplish this feat. One particular performer in Germany has a very remarkable act during which he is nailed fast to a board, the nails passing through the palms of the hands and through the feet. He is not hypnotized before the performance. Hypnosis may in some individuals inhibit the function of the sensory nerves, so that the feeling or pain is not registered in the brain.

For example, you may have been interested in some work and found that after completion of the work, you had either cut yourself or burned yourself at sometime while busily engaged, and yet you wondered why you didn't feel it. The same reason applies here as in the case of "self hypnosis."—EDITOR.

DISLIKES GAMBLER'S TRICKS

Editor, SCIENCE AND INVENTION:

I am a boy eleven years old, and ever since I was seven I have been intensely interested in human physiology. I have read five books on it. Last summer I started to read SCIENCE AND INVENTION. I thought that it was written, arranged and edited in a most strikingly fine way. Although I have studied the human body, I am by no means well acquainted with the mysteries of electricity and astronomy. Your magazine has done more to help me in this way than any printed matter I have ever come across. One of the things I particularly admired was the way those serial stories were written. "The Man on the Meteor" I think was written with such exactness, in such fine language, that it could rank with the good scientific novels and be far above that class of trashy narratives so much in circulation now. If Mr. Cummings is now a reader of this magazine, I take this opportunity to congratulate him. I would never miss reading "Dr. Hackensaw's Secrets" by Clement Fezandié, and "The Living Death" by John Martin Leahy, is to my mind a fine example of a true scientific novel. But there is one thing in this fine magazine that seems to me out of place, and that is Mark Mellen's "Gambler's Tricks Exposed." I not only think it void of scientific interest, but consider it an encouragement of iniquitous and foolish ways of spending time and money.

Well, so much for the disagreeable part of the story. I want to congratulate you on this fine work, and hope that it will ever meet the success it deserves.

SAMUEL F. THOMAS,
New York City.

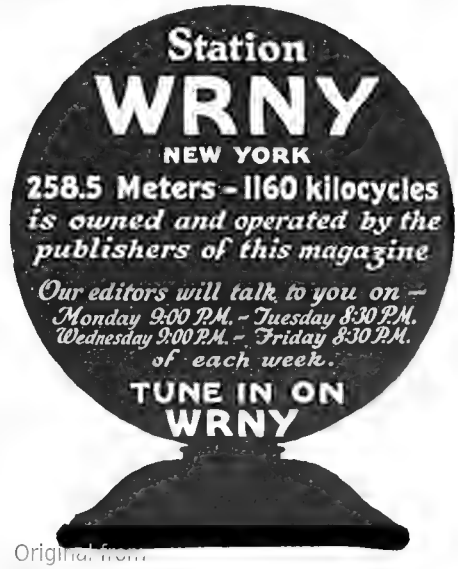
(You will notice that the gambler's tricks have been discontinued by this publication. Thanks for your compliments.—EDITOR.)

$250.00 for Killing Rats

SCIENCE AND INVENTION MAGAZINE offers the following prizes for the best new methods for exterminating rats. See July issue of this magazine for full details.

First Prize	$100.00
Second Prize	50.00
Third Prize	30.00
Fourth Prize	25.00
Fifth Prize	20.00
Sixth Prize	15.00
Seventh Prize	10.00

Suggestions must be accompanied with photographs or affidavits sworn to before a Notary, or if a trap is entered, a model must be submitted. Contest closes at noon in New York on October 15th. All suggestions must be in our hands at the time. The number of entries per person is not limited. In event of a tie for any of the awards, an identical prize will be paid to the contestants so tying. Address entries to Editor, Rat Contest, c/o Science and Invention, 53 Park Place, New York City.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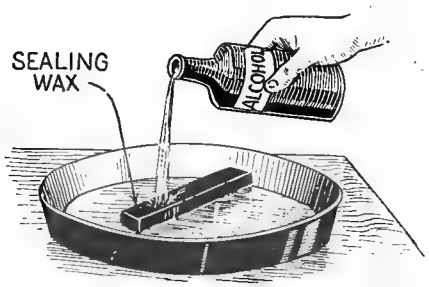
WRINKLES
RECIPES & FORMULAS

Edited by S. Gernsback

Cleaning Bottles

If a solution of mustard and water is poured into bottles allowed to stand for 30 minutes, and then removed, after having been shaken thoroughly, any odors left in the bottle by chemicals will be removed. —N. Greenspan.

Varnish

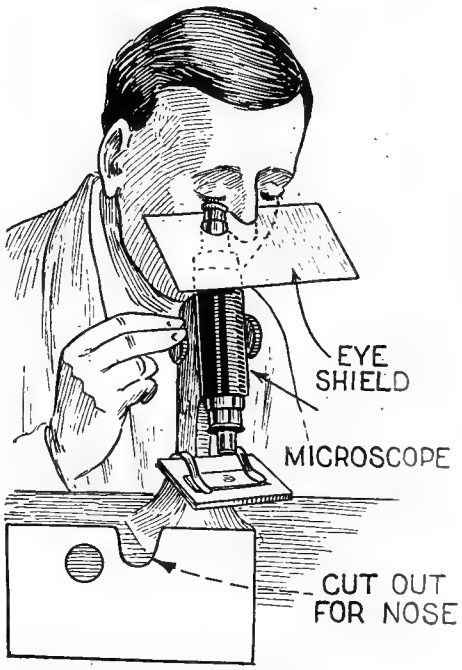


An excellent varnish may be made by dissolving sealing wax in alcohol. As the sealing wax may be obtained in all colors, many uses will be found for a varnish of this nature. It dries with a smooth, glossy surface that gives a very pleasing effect.
—A. A. Blumenfeld.

No-Glare Bulb

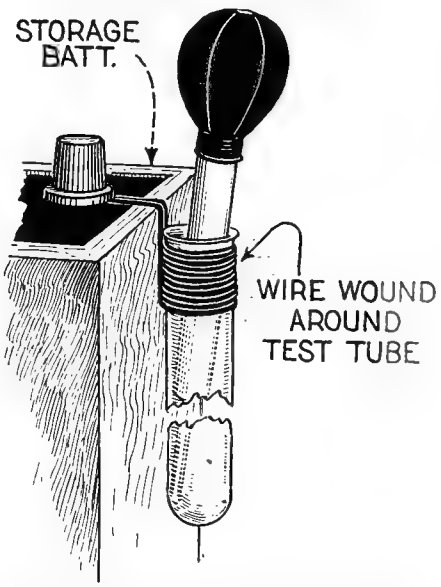
To reduce the glare from an electric light bulb, turn on the bulb until it is thoroughly warm and then wipe the surface with the face of a piece of carbon paper. Enough of the ink will adhere to the bulb to reduce the glare effectively.
—P. Boissineau Rep. No. 504.

Eye Shield



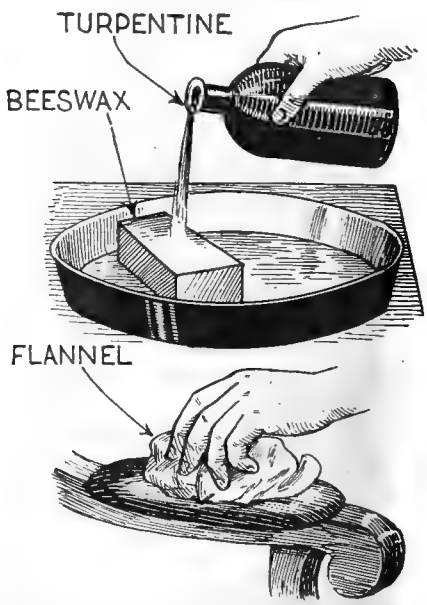
An eye shield for a microscope is of great assistance, especially where the instrument is to be used for long periods of time. One may be cut from cardboard to the shape shown, the hole corresponding in size to the barrel of the microscope. A mistake was made in the above drawing and the eye shield should be tilted at an angle opposite to that shown so as to exclude light from eye.—E. Zimmer.

Hydrometer Holder



A simple holder for a hydrometer can be made by hanging a large test tube from the edge of a storage battery by means of a wire wound as shown. In this position the hydrometer will always be at hand when it is desired. It can never get lost and furthermore will not drip over the carpet when removed from the battery after use.
—George A. Coates, Rep. No. 12,052.

Leather Polish



Dissolve a pound of beeswax in enough turpentine to make a mixture of the consistency of cream. This makes an excellent polish for leather and should be applied with a piece of flannel. —Peter Gudos, Rep. No. 21,320.

Hand Soap

A good hand soap can be made by mixing laundry soap with sawdust. First soften the soap with oil so that it can be thoroughly mixed with the sawdust. —Enrique Corral.

Cork Remover

If three pieces of wire are twisted together and the ends are turned at right angles as shown, a handy cork remover will be made. Place it in the bottle and shake until the cork is caught by the prongs. The cork can then be readily removed.
—Arthur Kern.

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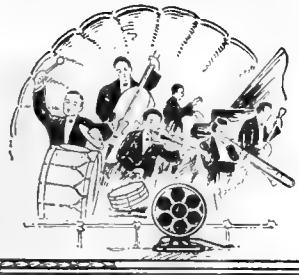
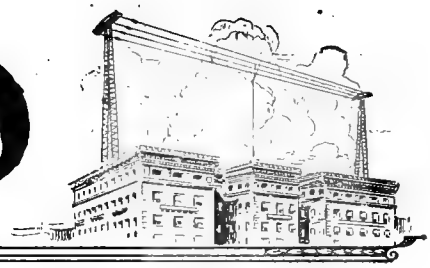
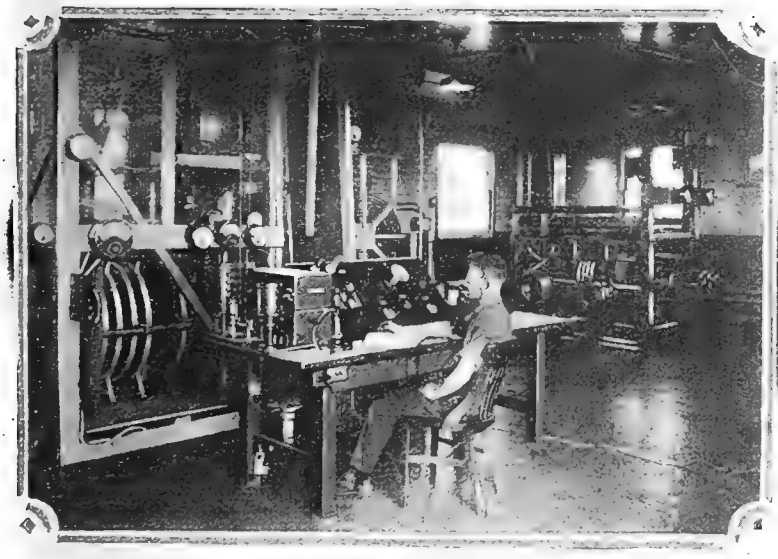


RADIO



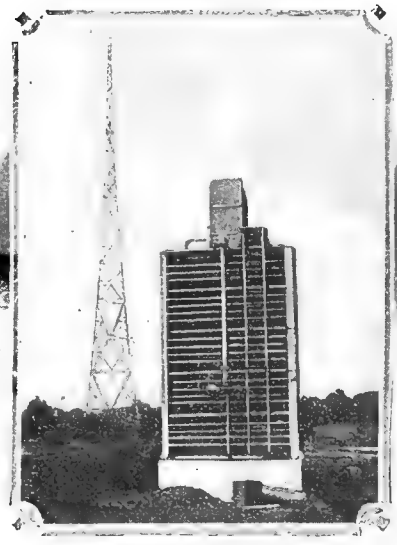
Superpower—Is It Here to Stay?

By JACK MILLIGRAM

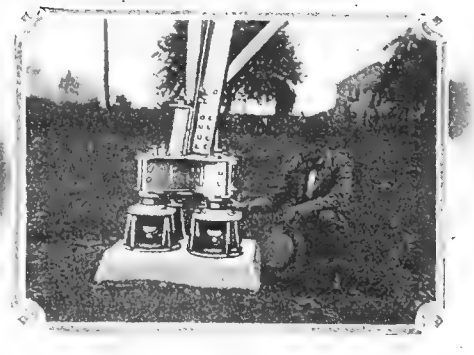


The photograph at the left below shows the transformers in the power line and the house which contains part of the power control apparatus at WJZ, Bound Brook, N.J.

Station WGY located at Schenectady, N. Y., has been conducting a series of tests on superpower in order to determine whether or not static and fading can be overcome by "brute force." To date, the results have not been as gratifying as one might expect from a station with 50 kilowatts of power. Part of the apparatus used at WGY is shown in the photograph at the left.



Above: The water cooler into which the water circulating around the high powered vacuum tubes at WJZ is fed in order to remove the heat that it has absorbed from these gigantic oscillation generators.



The photograph in the lower center above shows a general view of the new location of WJZ which by the time this article reaches you should be in operation or at least under final tests. The mast on the far side was not yet completed at the time this photograph was taken and some idea of the constructional methods used for these tall masts can be gained from the photograph. They rest upon solid concrete bases sunk many feet in the earth, but interposed between the actual steel of the mast and the concrete are huge porcelain insulators as shown in photograph in the lower right-hand corner.

THE question that is arousing the greatest interest among everyone at all connected with or in contact with radio today is that of superpower broadcasting. Let us first make clear to everyone just what constitutes such a proposition. Of course, you might call some of the stations that are in operation today on 2,000 or 3,000 watts, superpower stations, but in the writer's opinion, this is not the correct nomenclature. When we come right down to it, 3,000 watts or even 5,000 watts are not really superpower and so we believe that a station should not be designated as a superpower station unless it is using over 10 kilowatts output. Such is the case with WGY which station is in operation today and with WJZ, which by the time this article is being read will probably be conducting a series of experimental tests. It is expected that in the near future KGO will also bloom forth on high power. WGY is using 50 kilowatts. WJZ will have a similar rating and probably KGO will be in the same class. KDKA has also plenty of power "on tap." Looking "across the pond" we find a station has opened, operating on a power of 75,000 watts or 75 kilowatts. This station, located at Daventry, England, is owned and operated by the British Broadcasting Co.

WHY SUPERPOWER

Some people often seem to wonder why superpower broadcasting is considered to be a necessity. We can answer this quickly and easily. In the first place, more energy is radiated from a superpower station than from one of the ordinary type and therefore more energy is picked up in the receiving

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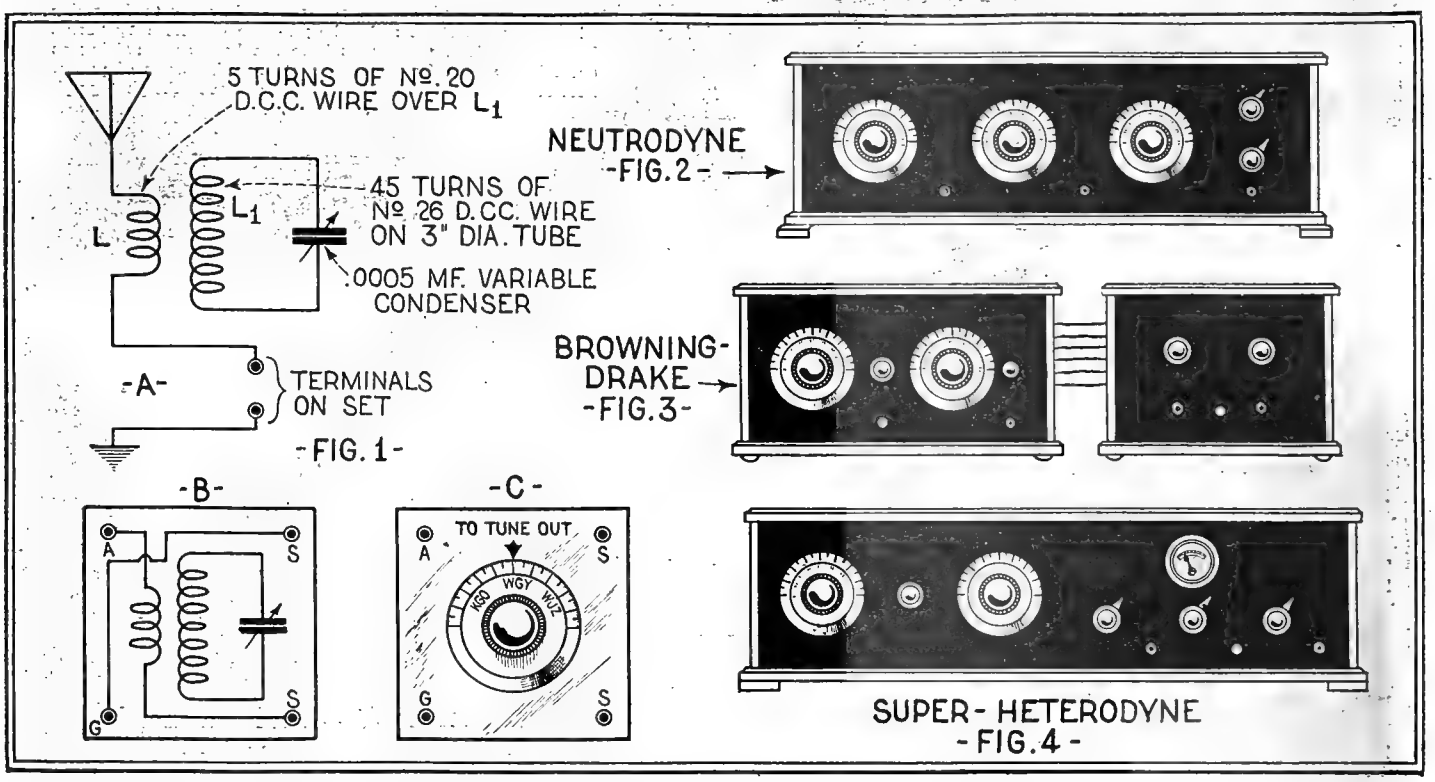
aerial. It of course follows that the volume produced by the receiving set will therefore be greater and the static-signal ratio will be greater. We cannot lower the static level but by using superpower we can raise the signal level to a point so far above the static that the latter will not be noticeable. Another reason put forth for the building of superpower stations is that with the greater resources behind the companies who promote this work, infinitely better programs can be presented to the public. Furthermore, when matters become stable, a few stations can supply the needs of the public where hundreds of others are needed today. Interference will be reduced and each station will have a correspondingly large group of listeners-in.

There are many opinions expressed today by those interested as to the effect of superpower. A good many are of the opinion that the erection and operation of such stations will not benefit the broadcast listener at all, but on the contrary will have a detrimental effect on radio in general. Others believe that a series of judiciously placed and correctly operated superpower stations will be of enormous benefit to everyone concerned. It is said that a series of 15 or 20 broadcast stations using 50 kilowatts power each and correctly spread over the surface of the United States could supply a diversified selection of entertainment to the listening public and that the various programs could be of such high class that this comparatively small number of stations could give the public everything that they could possibly desire in the line of broadcasting. Undoubtedly this is true and if certain features of the situation are carefully studied and followed by the engineers doing the work, superpower will undoubtedly be of great benefit to all. Such an arrangement as mentioned above would allow several different programs to be broadcast and with 50 kilowatts in back of each one, even the most ordinary three-tube receiving sets would be able to receive from any one of the stations desired even though it be 3,000 miles away by air line. With the proper spacing of these stations, no trouble due to interference will be experienced, except by those who live within a radius of three or four miles of a station. This number can be cut down to an enormous extent if a certain procedure is followed out in locating the stations. In the first place, a superpower station should not be located directly in the heart of a large city. To do this would be disastrous as it would cut off thousands of listeners from other stations during the hours that the superpower station was broadcasting. If, however, the antenna and power system for the station is placed out in some isolated part of the country, several miles from the nearest large town, the defects of superpower will be greatly reduced and it will be found that a comparatively small number of persons will be affected by the installation. Such is the case with the new locations of WJZ and WGY, photographs of which are reproduced herewith.



The three parts of Fig. 1, A, B, and C, show the details of an excellent type of absorption wave-trap that should aid in reducing interference from nearby high-powered stations. The trap may be incorporated in a single cabinet and the dial calibrated for tuning out certain high-powered stations. Figs. 2, 3 and 4 show our choice of good receivers for use in congested districts or where interference is bad.

A GOOD WAVE-TRAP

In order to help those who are located so close to high power broadcasting stations that their regular sets will not tune them out, and also to help those who do not have very selective receivers, an excellent type of wave-trap is illustrated in Fig. 1A, B and C. This is known as an inductively coupled absorption circuit and operates somewhat as follows. The signals coming in from the aerial to the set have to pass through the small coil L. Coupled closely to this coil L is another inductance L1. Shunted across the latter is a variable capacity. If now the circuit of this capacity and L1 is tuned sharply to any one of the waves being received, it will absorb that wave to such an extent that little, if any, energy from the particular broadcasting station operating on that wave-length will reach the receiver and hence the ears of the operator. Obviously with a variable condenser, many different stations can be cut out with a device of this nature. If you will incorporate it in a small cabinet, entirely separate from your receiving set, you can calibrate the dial after the manner shown in Fig. 1C. Note the points where certain interfering stations are eliminated and record them directly on the dial. Keep this wave-trap unit at least two or three feet away from your receiving set proper so that the field of the coil L1 will not interfere with the inductances in your receiving set. By the use of a device of this nature, you will undoubtedly be able to tune out even high powered broadcasting stations in the immediate vicinity even though the receiving set that you are using may not be particularly selective in itself.

Our choice of good receivers for use for the coming season is illustrated in Figs. 2, 3 and 4. Probably the best of these three is that shown in Fig. 4, and it is a standard type of well made Super-Heterodyne. Such a set when properly constructed will do just about all that can be desired towards selective reception. The other two sets shown run each other a very close second. One is a standard Neutrodyne that is properly constructed and operated, and the other is a Browning-Drake receiver such as that described in the September issue of this magazine. You will find any one of these sets to be most selective in operation.

A statement made to the writer by one of the officials of a company contemplating the erection of a superpower broadcasting station recently brought the following fact to light. This official said, that if the majority of the listeners-in are not satisfied with superpower broadcasting after they have had a fair trial of it, that the station will not continue with its proposed program, but will cater to the wishes of the majority and continue with their work in the same manner as has been their practice heretofore, or, in other words, on low power. Obviously, this is a fine sentiment and should be the one expressed by companies interested in this proposition. After all, the listener-in is the one who must be pleased, for without him, broadcasting is nothing.

WHO WILL PAY?

Now let us consider another aspect of this situation. Obviously superpower stations are going to cost money and lots of it. Not only is the intial cost of a station of this

(*Continued on page* 564)

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Radio As An Aid To Humanity

Above: A lifeboat put out from shore and equipped with a direction finding radio set to aid in locating boats in distress. Right: Broadcasting descriptions of criminals to aid in their capture.

A radio equipped lifeboat used for escaping from crippled or sinking vessels.

How radio can be of aid to physicians and surgeons.

LITTLE did Marconi dream, when he sent his first memorable signal consisting of the letter S across the Atlantic Ocean in 1901, that some day the science upon whose surface he was just beginning to make an impression would command the world-wide interest and use that it does today, only twenty-four years after his first trans-oceanic test. After those first experiments progress was slow. In fact, so slow was it that no legislation governing the use of radio was made in this country until 1912. From this point onward, however, the strides have been enormous and today we only have to look around us and read the daily papers to find out what important and tremendous parts radio plays in our everyday life. A great epoch-making step toward aiding humanity by radio was made when installations were first placed on board sea-going vessels for communication with shore. Most of us remember the heroic work of Jack Binns, the radio operator of the *Republic*, who, by sending out a distress signal and the location of his ship, saved the lives of hundreds of passengers. Without radio this could not have been done.

And so it goes that day by day further steps are taken in the development of radio apparatus and its applications. One of the greatest of these, and it relates to sea just as does the episode of the *Republic*, is the development of the radio direction finder. Today a vessel hundreds of miles out at sea can get its exact position on the surface of the globe, by radio even though the chronometer and other apparatus may be out of order. After sending out a certain signal, which is received by a so-called radio compass, computations are made at the shore station and the position of the vessel is plotted. This position is then transmitted back to the ship. Commanders of many vessels avail themselves of this service as a check against the calculations of the navigating officers.

Radio to an extent is putting the chronometer in the background for the ocean navigator. The radio direction finder has also been applied to another phase of saving life at sea. As in the two illustrations above, lifeboats on board many ships are being equipped with small, compact, yet powerful radio transmitters which can be employed to send out distress signals after the ship has been deserted in time of distress. For use in connection with these radio equipped lifeboats, direction finders have been installed on various small boats which put out from the shore and during foggy weather these boats can circle around until they pick up the exact location of the lifeboat from the ship in distress and can thus locate it and guide its occupants safely to shore. Of course, the signals sent out from the transmitter are also often of aid otherwise, inasmuch as they may be picked up by large vessels. If the operator on the

(*Continued on page* 570)

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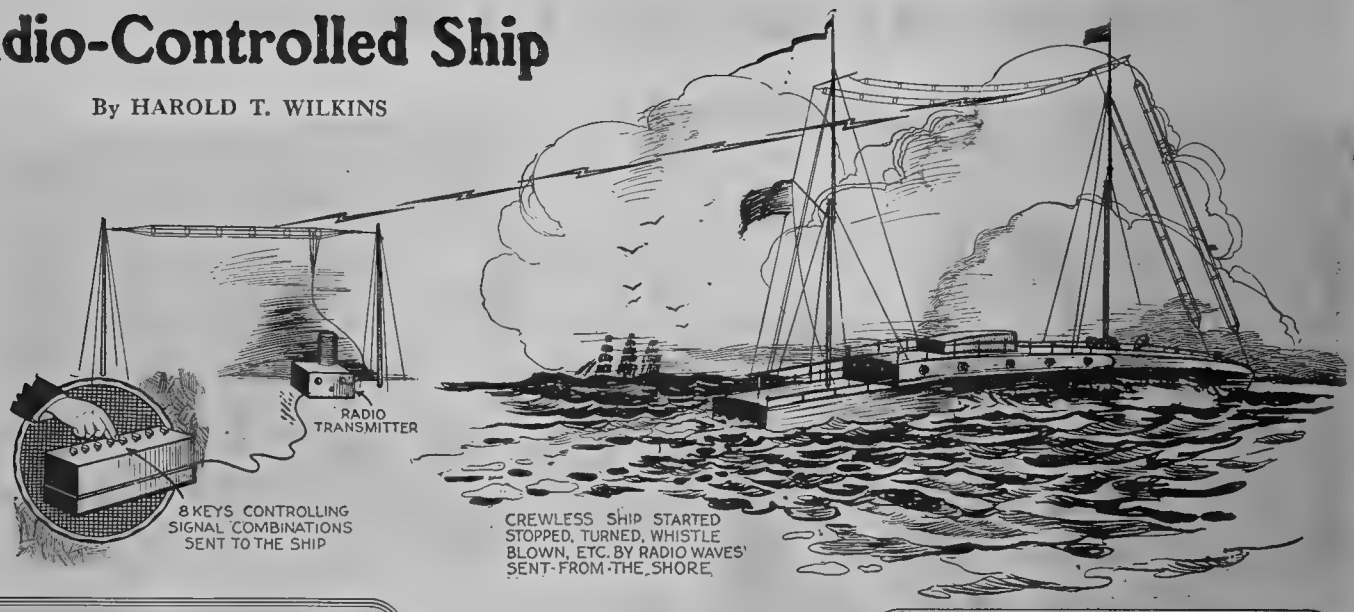
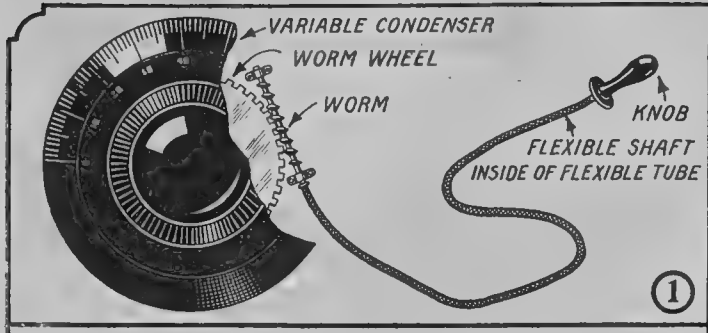
Radio-Controlled Ship

By HAROLD T. WILKINS

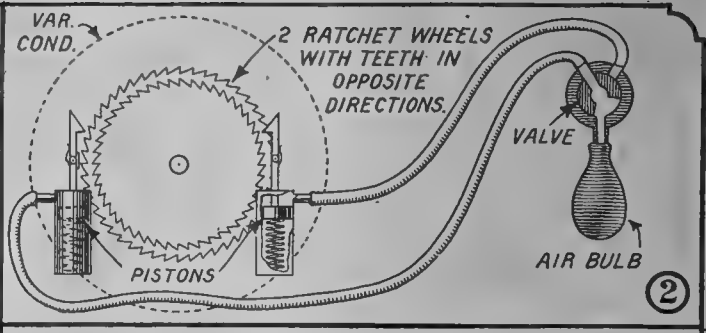

RADIO TRANSMITTER
8 KEYS CONTROLLING SIGNAL COMBINATIONS SENT TO THE SHIP
CREWLESS SHIP STARTED STOPPED, TURNED, WHISTLE BLOWN, ETC. BY RADIO WAVES SENT FROM THE SHORE

A new type of radio controlled ship was recently demonstrated in the Gulf of Spezia. An oil burning launch entirely devoid of crew sped swiftly toward the sea, stopped, swung on a new course back toward the shore, sounding her siren at intervals. She also darted to the right and to the left under the direction of the radio brain situated on a nearby terrace. Signore Professor Fiamma is the inventor of the radio control which made this possible. The underlying principle of the system is the transmission of several wave-lengths, an impulse of each wave causing certain mechanical movements to take place on board the ship. Eight different wave-lengths control eight separate movements of the mechanism. The ship is shown at anchor at the left and its inventor at the control box at the right.

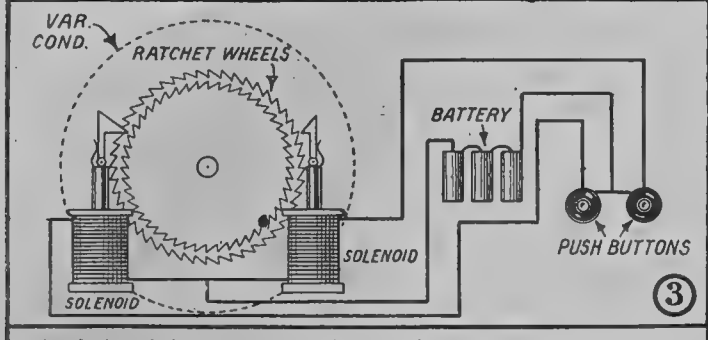
Mechanically Controlled Tuning Dials



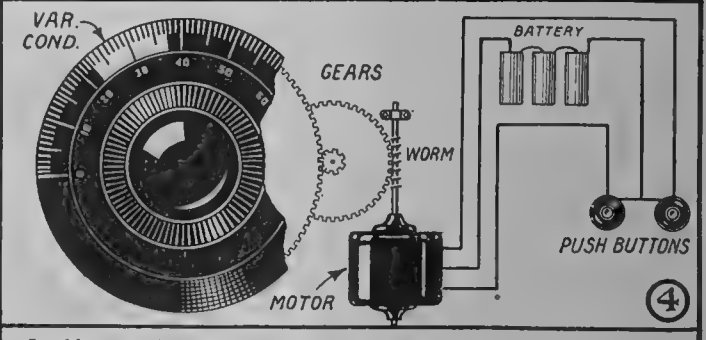
Several devices are suggested here which will eliminate the necessity for turning the dials on a radio set. Above: A flexible shaft turned by a knob operates a worm gear which in turn revolves another gear attached to the shaft of the instrument.



Here is another type of mechanical control wherein compressed air from a bulb actuates one or the other of a pair of cylinders, according to the direction in which the valve is turned. Specially designed plungers actuate ratchet wheels in opposite directions.



A principle similar to that shown in Fig. 2 is here shown adapted to electrical operation. Two solenoids each connected to a push button operate the plungers which in turn actuate ratchet wheels in opposite directions, so that the dial can be turned either way desired.



In this type of mechanical control, a reversible electric motor drives a series of gears which operate the shaft of the variable instrument. Either one button or the other is pressed according to the direction in which the operator desires the dial to be turned.—H. W. S.

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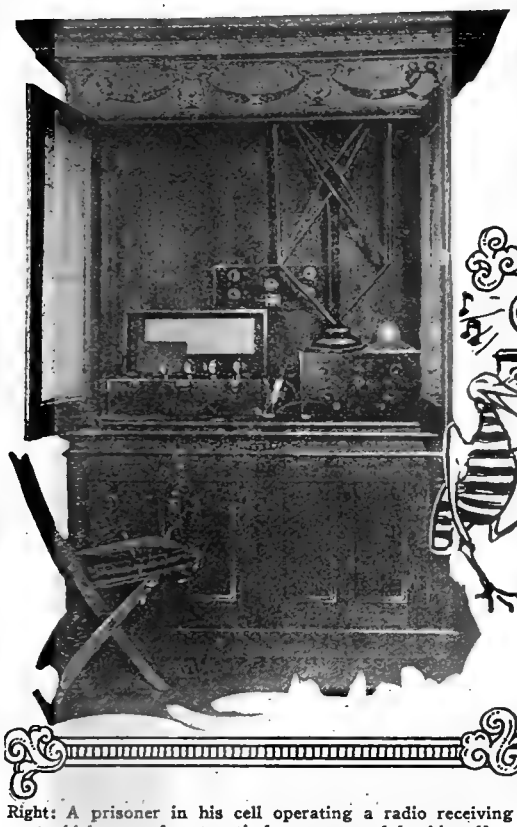
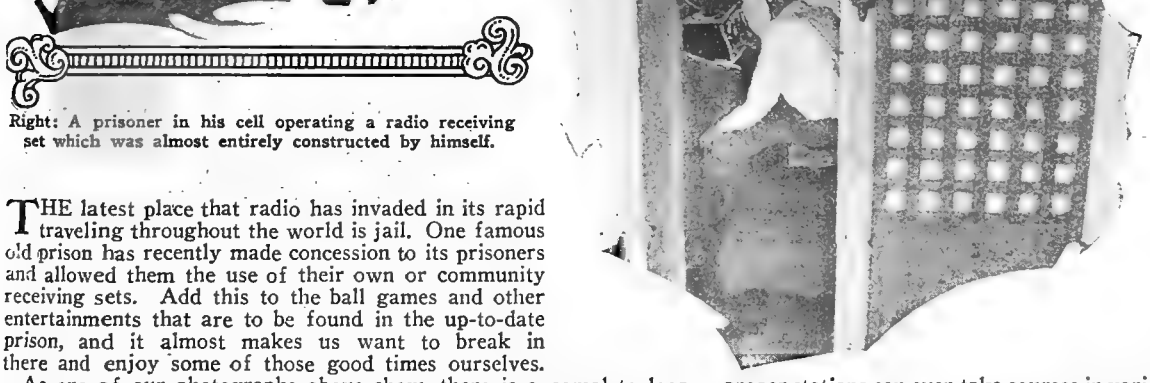
Radio Enters Jail



Left: The radio set that supplies inmates of Sing Sing with entertainment. Note the power amplifier at extreme left.

The photograph above shows another radio set installed at the desk of one of the keepers. With its amplifier and loud speaker, it is capable of supplying music and entertainment to many prisoners.



Right: A prisoner in his cell operating a radio receiving set which was almost entirely constructed by himself.

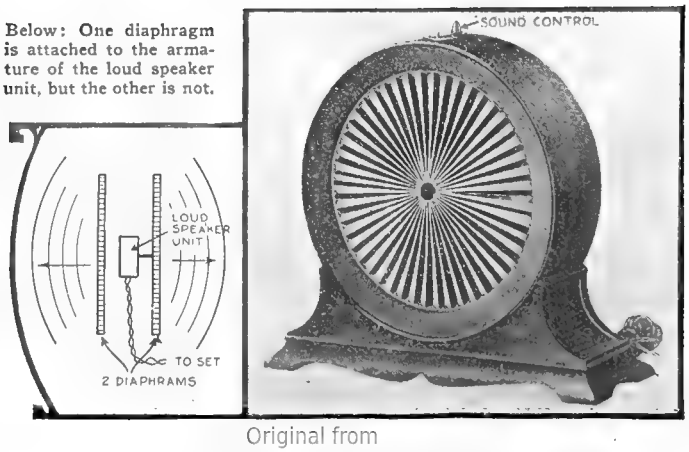
THE latest place that radio has invaded in its rapid traveling throughout the world is jail. One famous old prison has recently made concession to its prisoners and allowed them the use of their own or community receiving sets. Add this to the ball games and other entertainments that are to be found in the up-to-date prison, and it almost makes us want to break in there and enjoy some of those good times ourselves.

As one of our photographs above show, there is a complete loop receiver in use that enables the operator in charge to tune in many broadcasting stations throughout the country. From this set the music and entertainment can be distributed to auxiliary loud speakers throughout the prison and thus all can be served from the one set. Not only is this done, but there are many other sets in use in this jail. For instance, as shown in the upper right-hand corner, one of the wardens in charge of a particular section of the jail has a set and loud speaker at his desk. With it connected to an outside aerial, he gets volume enough for a good many of those in the immediate vicinity to hear what is going on. Undoubtedly it is possible for the prisoners to learn many things in this way. They can keep up-to-date on happenings in the outside world, and if they tune in to the proper stations can even take courses in various subjects by radio. Furthermore, in the workshops of the prison they can learn the mechanical side of radio and thus a new trade is opened to the prisoner. He can learn to make various instruments and to assemble and wire up radio sets. Furthermore, if he is of a studious nature and desires to do so, it is possible for him to obtain books on the theoretical side of the subject and thus equip himself mentally for a new position when he is released. Obviously the application of radio in this way is a great asset to humanity.

New Paper Disk Loud Speaker

A new type of loud speaker that incorporates several advantages over other types and that is decidedly an artistic addition to any radio receiving set is illustrated at the extreme right. A diagrammatical view of the principle upon which it works is shown immediately to the left of the photograph. Contrary to the usual practice, the manufacturers of this device did not merely incorporate a receiver unit in it for its actuating mechanism, but designed and built an especially sensitive, yet rugged unit as the operating mechanism. This speaker makes use of two separate diaphragms or paper disks. One of these is connected by a rigid armature to the moving element of the loud speaker unit. The other diaphragm or disk is not physically connected to the armature, but is in acoustic resonance with the connected disk. In this way sound given out by this loud speaker is not directional in only one way, but the loud speaker can be placed in the middle of the room and the sounds will be equally distributed. Actual tests have shown that this type of speaker responds equally well to high and low musical tones, and that the base notes are not over-emphasized as is often found to be the case. A control is provided to compensate for atmospheric changes.—*Photograph courtesy Victor Talking Machine Co.*

Below: One diaphragm is attached to the armature of the loud speaker unit, but the other is not.



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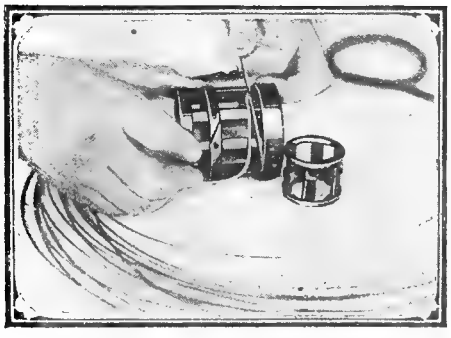
Converting Your Tuner to Short Waves

Tune In Below 150 Meters and You will Learn Some New Things About Radio

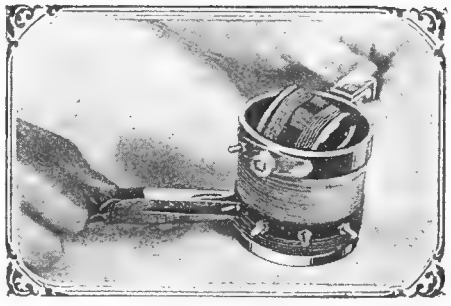
By HERBERT E. HAYDEN



Winding the bare copper wire and the heavy cord side by side on the secondary section of the stator form.

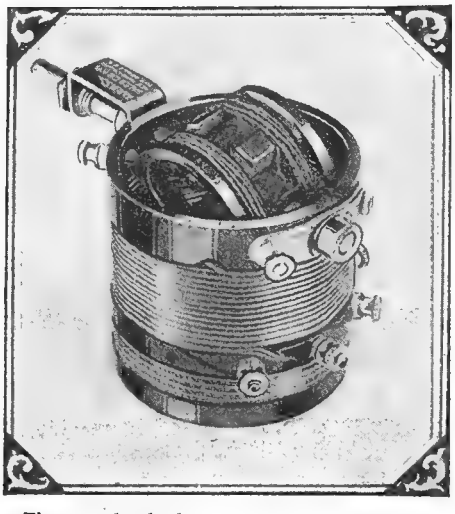
SINCE several short-wave radiophone broadcasting stations have been put into operation, the interest in these short waves has become great. KDKA broadcasting on 62 meters seems to be getting out over the country in an exceptional manner and many other stations experimenting with waves in this neighborhood have reported similar results. Not only are there many broadcasting stations on the short waves, but there are also thousands of code stations. The amateur bands centering around 40 and 80 meters hold a world of interest to anyone who can copy code and this knowledge can be picked up very easily with a little practice. We give herewith a list of the most important stations, both phone and code, which are operating on the short waves.

Wave	Call	Location
20.0	POX	Nauen, Germany
25.0	2YT	Poldhu, England
25.0	AGF	Nauen, Germany
26.0	AGA	Nauen, Germany
30.0	2XI	Schenectady
32.0	2YT	Poldhu, England
35.0	2XI	Schenectady
36.0	LPZ	Buenos Aires
38.0	2XI	Schenectady
40.0	1XAO	Belfast, Ireland
43.0	WIX	New Brunswick
47.0	POZ	Nauen, Germany
50.0	NKF	Anacostia, D. C.
56.0	KFKX	Hastings, Neb.
59.8	KDKA	Pittsburgh, Pa.
60.0	1XAO	Belfast, Ireland
60.0	2YT	Poldhu, England
62.0	KDKA	Pittsburgh, Pa.
67.0	8XS	Pittsburgh, Pa.
70.0	POX	Nauen, Germany
71.5	NKF	Anacostia, D. C.
74.0	WIR	New Brunswick
75.0	SFR	Paris, France
75.0	WQM	Rocky Point, L. I.
76.0	POX	Nauen, Germany
83.0	RDW	Moscow, Russia
84.0	NKF	Anacostia, D. C.
85.0	SFR	Paris, France
85.0	8GB	Kahuku, T. H.
86.0	NQC	Belfast, Ireland
90.0	6XO	Poldhu, England
90.0	1XAO	Paris, France
92.0	2YT	San Diego, Cal.
94.0	2YT	Poldhu, England
95.0	SFR	Paris, France
96.0	8XS	Pittsburgh, Pa.



Assembling the tuning unit after all of the sections have been rewound according to the data furnished in the text.

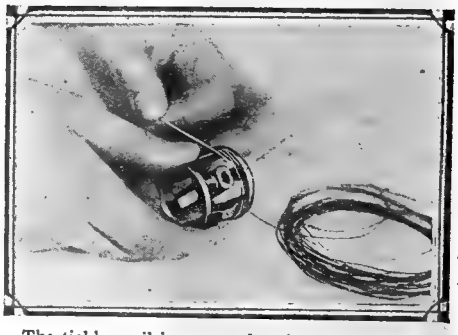
99.0	6XI	Bolinas, Cal.
100.0	POX	Nauen, Germany
100.0	2XI	Schenectady
100.0	NAM	Norfolk, Va.
103.0	WGH	Tuckerton, N. J.
107.0	2XI	Schenectady
112.0	1XAO	Belfast, Ireland



The completed short-wave coil, ready to be incorporated in the receiving set.

115.0	FL	Paris, France
120.0	1XAO	Belfast, Ireland
146.0	6XO	Kahuku, T. H.

In the September issue of this magazine the writer described a single tube portable receiving set that gives exceptional results. This set or any one of a similar type can be changed to a short wave receiving set very easily and the photographs detail all of the necessary operations. The circuit for hooking up the receiver remains exactly the same as shown in the September issue and the only change necessary is in the winding of the coils. The first step necessary is to remove all of the metal fittings from the frame of the stator and tickler coil. Then remove all the wire from all three of the coils. Secure about 25 feet of braided copper wire or if this is not available, the same quantity of No. 16 bare copper wire may be employed. Fasten one end of which ever wire you get to the coil form and wind the wire on the form, spacing each turn with a piece of cord about the same size as the wire. This can be done by winding the cord and the wire side by side on the form. The result will be as pictured. Wind both the primary and secondary in this way, placing four turns on the former and twelve turns on the latter.

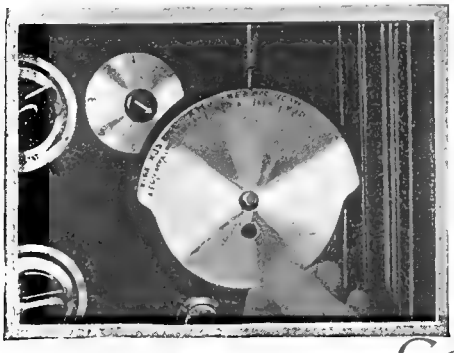


The tickler coil is rewound, using the wire that was removed from the original secondary. Twelve turns are to be used.

For rewinding the tickler coil, use the wire that was removed from the secondary and wind 12 turns of it on the rotor form. Now put all the parts together again, fasten the wires to their respective binding posts and you will have a coil of the type shown in the photograph.

The writer found that a coupler built after the specifications given above would tune from 35 to 150 meters with a .0005 mf. variable condenser shunted across the secondary. Oscillation and regeneration control are very smooth. After rewiring this coupler into your set you will be able to listen in on many stations that you never heard before and the writer is sure that you will be well pleased with the results obtained.

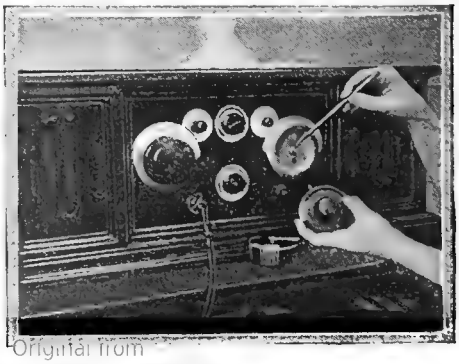
If you desire to receive from even shorter wave stations than those which this coil will reach, take a tap off the secondary. Two taps may be necessary in order to get good flexibility. However, this can be quickly determined by experimenting and no set rules need be given here.



Tuning Aid

In order to avoid the necessity of constant reference to a log book or list of stations, the little hint illustrated at the left and right may be brought into service. Disks of thin aluminum, one for each dial, are cut to the shape shown and rubbed with emery paper. Mount them behind the dials and when a station is tuned in at its best, mark the location on the aluminum disks. Thus at any future date you can readily turn to the desired setting. If standard dials are used, attach a pointer as at right.

—Frank M. Blackwell.



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Hints for the Radio Builder

Part II

By LEON L. ADELMAN, Assoc. I.R.E.

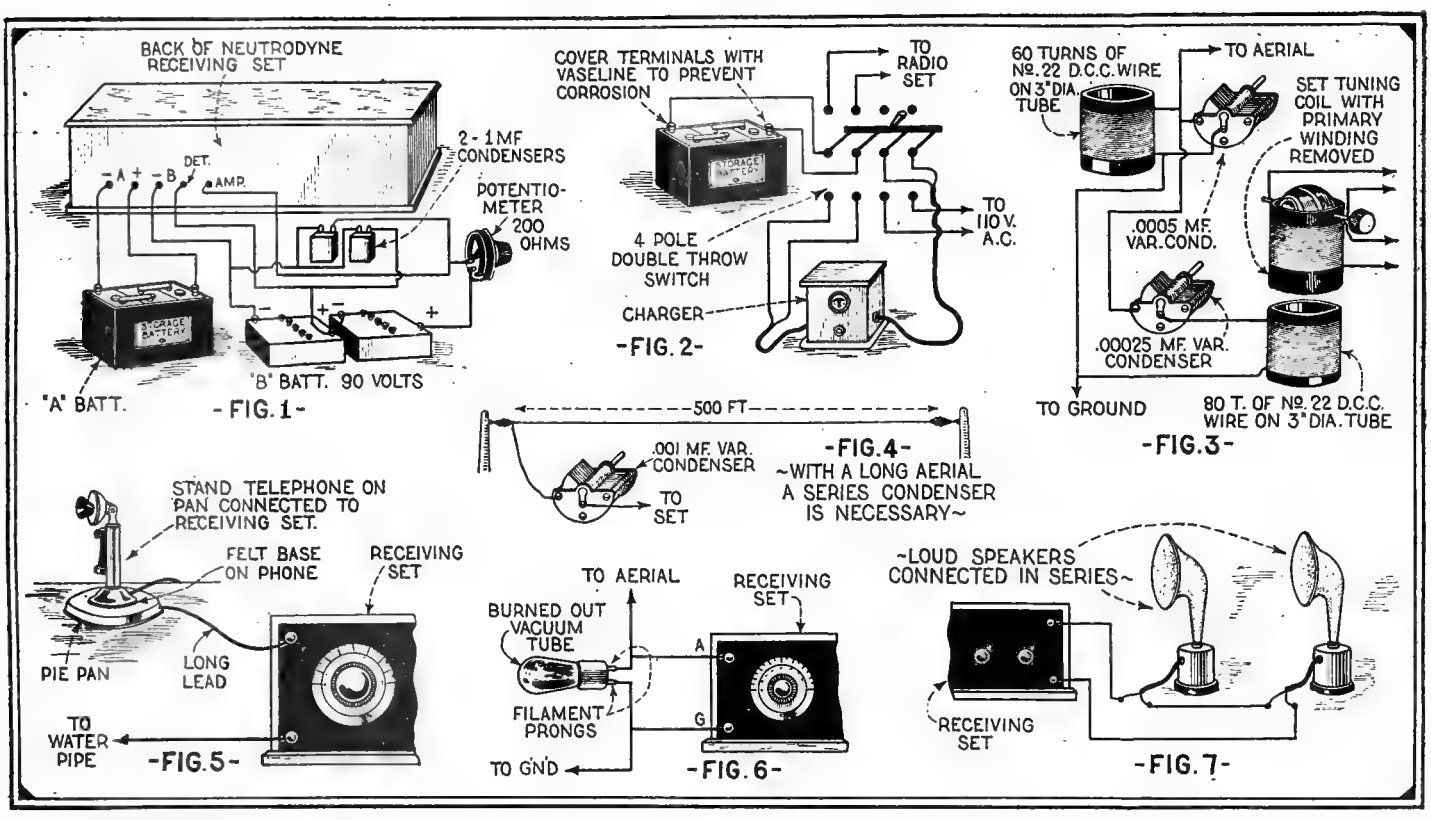

Fig. 1. Aids in the clarifying of reception using a neutrodyne receiver. The kink shown may also help other sets. Fig. 2. Use a switch as shown with your charger and "A" battery and you will not have to disconnect wires. Fig. 3. This wave-trap will help eliminate interference. Fig. 4. Where there are no local stations, a long aerial gives excellent reception. Use a series condenser with it. Fig. 5. A good type of make-shift aerial. Fig. 6. A burned out vacuum tube as a lightning arrester. Fig. 7. Connecting two or more loud speakers to one set.

MANY of us who own neutrodyne sets, especially when they are of the home-made variety, find that they squeal and howl considerably on certain wave-lengths. The following advice is given to those who are anxious to clear up the trouble.

First make sure that all connections are tight. Take voltage readings on both the "A" and "B" batteries and ascertain whether they are in good condition. Do not allow the "A" battery voltage to drop below 5.1 volts. Recharge it immediately in order to prolong the life of the battery. See that the solution in the jars covers the top of the plates. If not add pure distilled water. If this is not available, rain water caught in a perfectly clean vessel will do. Do not use ordinary tap water as it contains impurities which may injure the battery.

Having made certain that the batteries are in prime condition, the next step to take is that of bending up the contact springs of the tube sockets so as to insure good connections. Also clean the tube prongs with a file. A poor contact means that a very high resistance is introduced into the radio frequency circuits which makes for inferior results.

The variable tuning condensers should then be carefully attended to. The bearings should be tightened if possible and the plates thoroughly cleaned of all dust particles. Make sure that the rotor plates are evenly spaced and that they do not touch the stationary ones.

Place a 1MF by-pass condenser across the negative "B" and positive 22½-volt "B". Also, place a 1MF condenser across the total voltage of the "B" battery. Insert a 200- or 400-ohm potentiometer in series with the positive 90-volt lead. (see Fig. 1.) Regulation of the potentiometer will prevent over-regeneration, the cause of squealing. The potentiometer arm should be so adjusted that maximum clarity is obtainable.

In the construction of the set, it may be possible that the coils were not placed in exact alignment. In this case, excessive magnetic linkage may exist and lead to regeneration by inductive coupling. Usually, this regeneration is sufficient to unbalance neutralization and squealing will become manifest.

It is therefore advisable to correct this fault by aligning the coils more carefully at the correct angles.

The various tubes should be interchanged in the different sockets, as sometimes a tube will work much better as a detector or an audio frequency amplifier than as a radio frequency amplifier and vice-versa.

CHARGING "A" BATTERIES

As has been mentioned before, the "A" battery should be recharged when the voltage has fallen to 5.1 volts. Rather than experience the inconvenience that would result when the battery is to be disconnected from the receiving set and then connected to the charger, it is best to employ a four-pole, double-throw switch. In this way, it becomes possible to instantaneously disconnect the battery from the set, turn on the power for the charger and connect the battery to the charger. If a four-pole, double-throw switch is not to be had, two small double-pole, double-throw switches will serve the purpose admirably. (See Fig. 2). It will be better to fasten the handles of both switches together by a small length of hard rubber or wood strip.

The complete outfit should be placed underneath the table out of the way, while the switch, if mounted under the top of the radio table, will be found quite handy whenever needed. The average battery of 100 ampere-hour capacity needs recharging about every 10 days and a steady charge of 8 hours will be found sufficient to keep it in trim.

INTERFERENCE

Many of us who live in congested areas are troubled with interference from nearby broadcast stations. The use of the wave-trap has resulted in most instances in completely overcoming the interference situation. An even better arrangement is the combination "acceptor-rejector" circuit. It can be made very easily by following the information given below and illustrated in Fig. 3. The trap circuit consists of an inductance of 60 turns of No. 24 DCC wire wound on a 3-inch diameter form and is tuned by a .0005 mf. condenser. The acceptor circuit is comprised of an inductance of 80 turns of the same size wire and is tuned by a series condenser of .00025 mf. capacity. In wiring the unit to the receiver, the primary is removed and the 80-turn coil is coupled directly to the secondary of the set. In operation, the acceptor circuit is tuned to desired signal and then the rejector circuit tuned to the position of best results. All other frequencies will be passed to the ground and will not affect the receiving system.

If, on the other hand, one does not care to go to the slight expense or trouble involved in making such a device, the antenna should be so modified that it consists of a single wire not more than 60 feet long.

(*Continued on page* 589)

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The Radio Constructor

How to Build a Complete, Compact, Low Power C. W. and Phone Transmitter

By A. P. Peck, Assoc. I. R. E.

SO many of our readers have expressed interest in the subject of radio transmission, both in code and by phone, that we have decided to present some detailed information on the subject, which, if carefully followed, will enable the reader to obtain very good results in transmission. This month's article will deal with the construction of a very simple transmitter, using a high voltage "B" battery for supplying the plate potential. More of this later on.

LICENSE REQUIRED

Before attempting any transmission whatsoever, the reader must remember that this work cannot be done without a government permit which takes the form of two licenses. One of these licenses is for the station and the other is for the operator. The first of these can be obtained as soon as the station is put into actual operation and as soon as the wave-length has been set at which the station is to be operated. The license for the operator, however, must be obtained first. You need not even have a transmitting station in order to get an operator's license, but you must have an operator's license before you can get a station license. The operator's license is comparatively simple to obtain, and the only thing that will hold you back at all is the code speed test which you must pass. In order to operate an amateur station, one must be able to receive at a speed of at least ten words per minute in the International Morse Code. In order to attain this speed, constant practice for a period of one or two months is quite necessary. A copy of the code is given on the opposite page. Equip yourself with a key, buzzer and battery connected in series so that when the key is pressed, the buzzer will operate. Practise the code with this arrangement and also if possible listen in on some of the amateur transmission that is always going on. Try to copy some of the code that you hear, and after some practice you will be able to do so.

In any event, you will have to equip yourself with a good short-wave receiver before you can do any actual work in amateur circles, and therefore we would suggest reference to the article on this subject appearing in the November, 1924, issue of *Science and Invention*. After you have acquainted yourself sufficiently with the code and put it into practice, you should proceed to the nearest Custom House or Radio Inspector's office and take your examination for a first grade amateur operator's license. If, however, you live too far from this point to make the trip, you can obtain a second grade amateur operator's license by applying by mail to the Radio Inspector. He will furnish you with blanks which must be filled out and returned, whereupon your license will be issued. This, however, is good for only one year and within that time you must appear for a personal examination.

"B" BATTERY AS PLATE SUPPLY

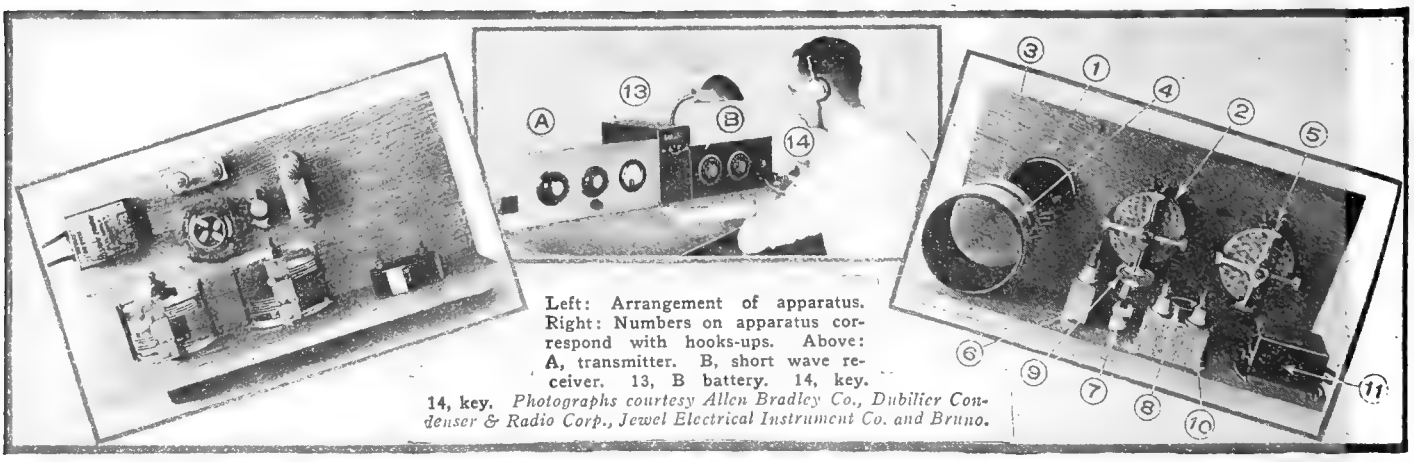
In the type of transmitter that we have illustrated on this and the two succeeding pages, a storage "B" battery is used as the plate supply. Dry "B" batteries could of course be used, but the drain on them would be so great that the operation of the set would not be at all economical. With a storage "B" battery which can be charged frequently, operation will be more reliable. If you use a set of this nature for three or four hours every night, the "B" battery should be charged at least every other day or possibly every day.

Do not think that just because higher power is not used in this set that it will do no good work. In fact, many United States amateurs have made contact wth European amateurs using only a UV-201A tube with a potential on the order of 150 volts applied to the plate. This of course is rather exceptional work, but with a set of the type described, you can easily depend upon transmission over a radius of 100 miles and even more with C. W., as continuous wave code transmission is known, or over a distance of 5 or 6 miles on phone. The set is rather inexpensive to build.

Even though high voltage is not used, there are certain of the instruments which should be purchased with the idea in mind, that sometime you will want to increase the power of your set. You will undoubtedly want to do this as soon as you have been on the air for a few days and have been deeply bitten by the transmitting bug. Therefore, when you buy meters, obtain good ones inasmuch as poor meters are an unwise investment. The same rule applies to variable and fixed condensers. In the set illustrated here, the two fixed condensers shown can be used in any type of amateur transmitter with powers up to 100 watts or even more. Obviously, they are far over size for the type of transmitter under discussion, but you might as well get them now and then you will have good condensers that can be used in other sets. The same applies to the variable condensers—get good ones at first and you cannot go wrong. The writer is using two of the type shown in this set in connection with another amateur transmitter in which a 50-watt transmitting tube is incorporated. These variable condensers stand up very well even under high plate voltage, and only one of them has arced over and that only happened once when the transmitter was not properly adjusted.

The two tuning condensers, one of which tunes the oscillating circuit and the other of which tunes the antenna circuit, should have a capacity of .0005 mf. For 80-meter work, use only half of the antenna condenser. The two blocking condensers or grid and plate condensers should have a capacity of .002 mf. and as mentioned above, should be made of high grade material. It is not wise to try to construct these condensers yourself, as you will undoubtedly encounter serious trouble. Of course, if you wish to use only low power and are sure that you will never want to build a higher powered set, small receiving condensers of the mica insulated type can be used for these blocking condensers, and will give satisfactory results.

The grid leak should by all means be variable as by the proper adjustment of this instrument much greater efficiency and a better transmitted tone can be obtained. A carbon disk resistance of the type illustrated with a maximum resistance of 100,000 ohms will be found quite satisfactory.



Left: Arrangement of apparatus. Right: Numbers on apparatus correspond with hooks-ups. Above: A, transmitter. B, short wave receiver. 13, B battery. 14, key. 14, key. *Photographs courtesy Allen Bradley Co., Dubilier Condenser & Radio Corp., Jewel Electrical Instrument Co. and Bruno.*

THE INDUCTANCES

Undoubtedly you will want to try working on both of the two upper wave-length bands that are in use today, namely those centering around 80 and 175 meters. To be more exact, these bands cover from 75 to 85 meters and from 150 to 200 meters. C. W. transmission can be used over both of these bands and phone transmission can be used between 170 and 180 meters. The inductances for both bands are to be wound on 4-inch diameter insulating tubes. Well paraffined cardboard will be found quite satisfactory.

For the 80-meter band, wind the oscillator or primary coil with 19 turns of No. 14 D.C.C. wire, soldering a lug or tap at the center turn. The antenna inductance should have from 6 to 10 turns and must be determined definitely by experimenting. Use enough turns to have a good pick-up from the oscillating circuit, but do not use so many that they will stop the primary circuit from oscillating.

For the 150- to 200-meter band, use the same diameter tubing and wind 39 turns for

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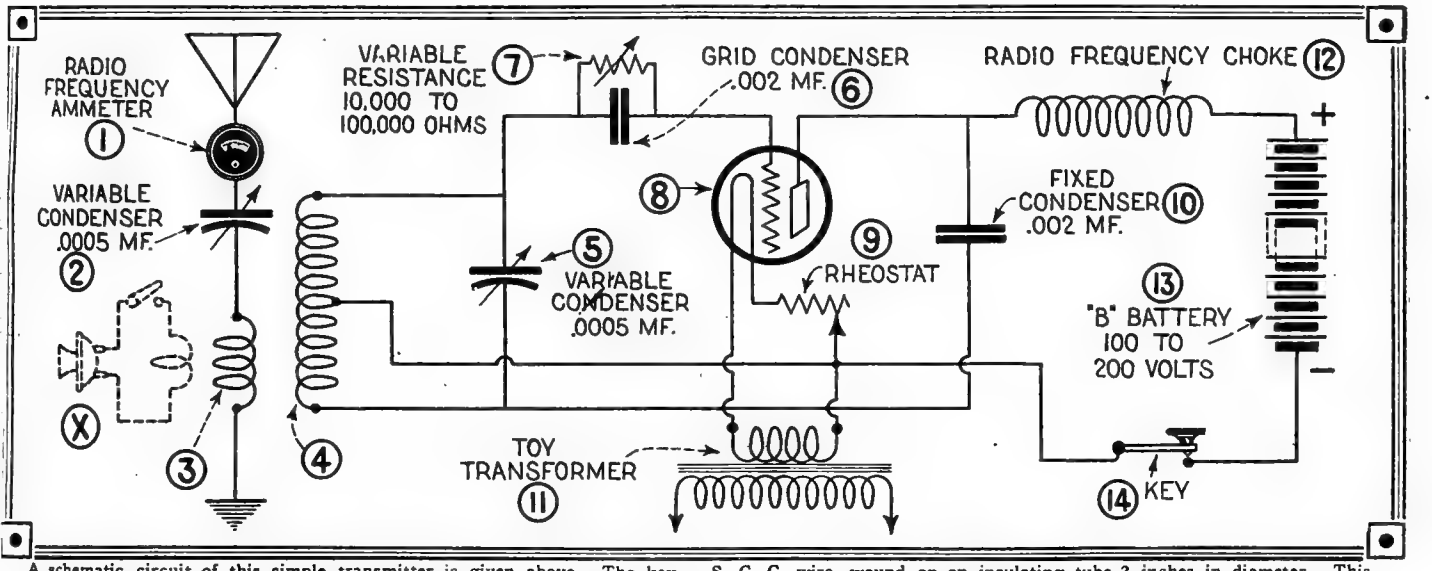


A schematic circuit of this simple transmitter is given above. The key must be closed when the set is being used for radiophone transmission. The radio frequency choke, 12, consists of 250 turns of No. 28 or No. 30 S. C. C. wire, wound on an insulating tube 2 inches in diameter. This coil is not shown in the photographs on the opposite page. The rheostat is of a standard carbon disk compression type.

the primary or oscillator coil. Tap at the 20th turn. The secondary or antenna coil can be approximately the same size as that used for the 80-meter tuner. In connection with this 150- to 200-meter inductance, you will want to incorporate some sort of modulating system so that you can use radiophone transmission between 170 and 180 meters. The simplest and easiest way to accomplish this is by using an absorption circuit. This consists of two turns of wire shunted by a microphone as shown in dotted lines in the schematic circuit of the transmitter. Place a switch in series with the microphone, so that this circuit can be opened when you are using C. W. transmission on the upper band of wave-lengths. The two turns of the absorption circuit are placed inside of the supporting tube and are wound so as to be held there by friction. Their position in relation to the primary should be varied until the best operating point is found. This can be determined while working with some nearby station or by listening in on your own receiver to your transmitted wave.

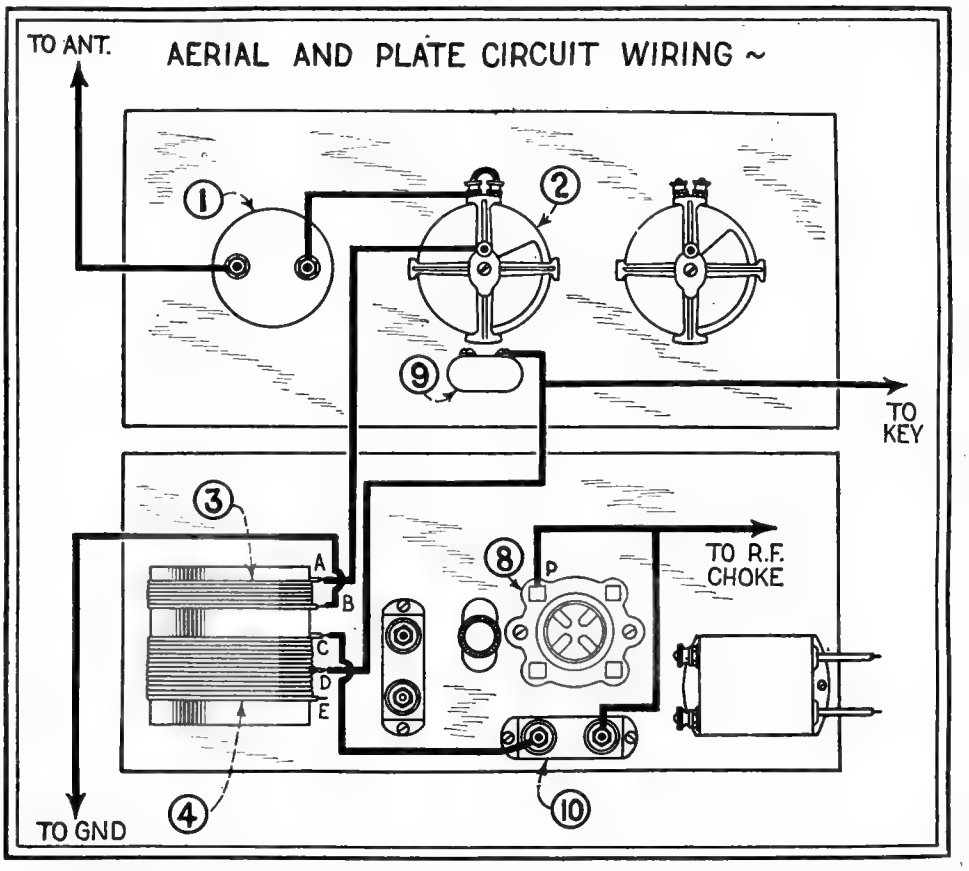
METERS

In the set illustrated we have only shown one meter, an antenna radio frequency ammeter. This instrument shows you when your antenna circuit is in resonance with the oscillating circuit. Do not depend too much upon the amount of current shown by this meter and do not think that just because you get a high antenna reading you are getting out further. This does not always follow, and only a few hours of experimenting and trying out different settings of your variable condensers will determine just where the best point is for operation. However, the antenna meter is useful for tuning to resonance and therefore should be included. If you want to make a set somewhat more elaborate, incorporate a filament voltmeter and a plate milliammeter. You will need these instruments anyway when you build a larger set and come to use A.C. or motor generator power supply. It is best to buy three meters; one for the antenna, one for the filament and one for the plate. Then you will be fully equip-

(Continued on next page)

A	•—	0	— — —
B	—•••	P	•— — •
C	—•—•	Q	— — •—
D	—••	R	•— •
E	•	S	•••
F	••—•	T	—
G	— —•	U	••—
H	••••	V	•••—
I	••	W	•— —
J	•— — —	X	—•• —
K	—•—	Y	—•— —
L	•—••	Z	— — ••
M	— —		
N	—•	&	• •••
1	•— — — —	6	—••••
2	••— — —	7	— — •••
3	•••— —	8	— — —••
4	••••—	9	— — — —•
5	•••••	10	— — — — —
PERIOD	•• •• ••	INTERROGATION(?)	•• — — ••

Above is given a chart of the code that you must learn in order to send and receive radio messages with this C. W. transmitter. You must be able to pass a speed test in order to get your transmitting license. The requirements are ten words per minute, five letters to the word.



Above is shown the first of our famous progressive wiring diagrams in which the aerial and plate circuit wiring is shown in detail. The grid leak is mounted on the baseboard rather than on the panel so as to reduce the length of the grid leads. Once it is adjusted for best results, it need not be changed until the tube itself is replaced by another. However, a change in the grid leak adjustment will sometimes be found beneficial when shifting from one certain wave to another in a different band. Details of coils are given on the next page.

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The Radio Constructor

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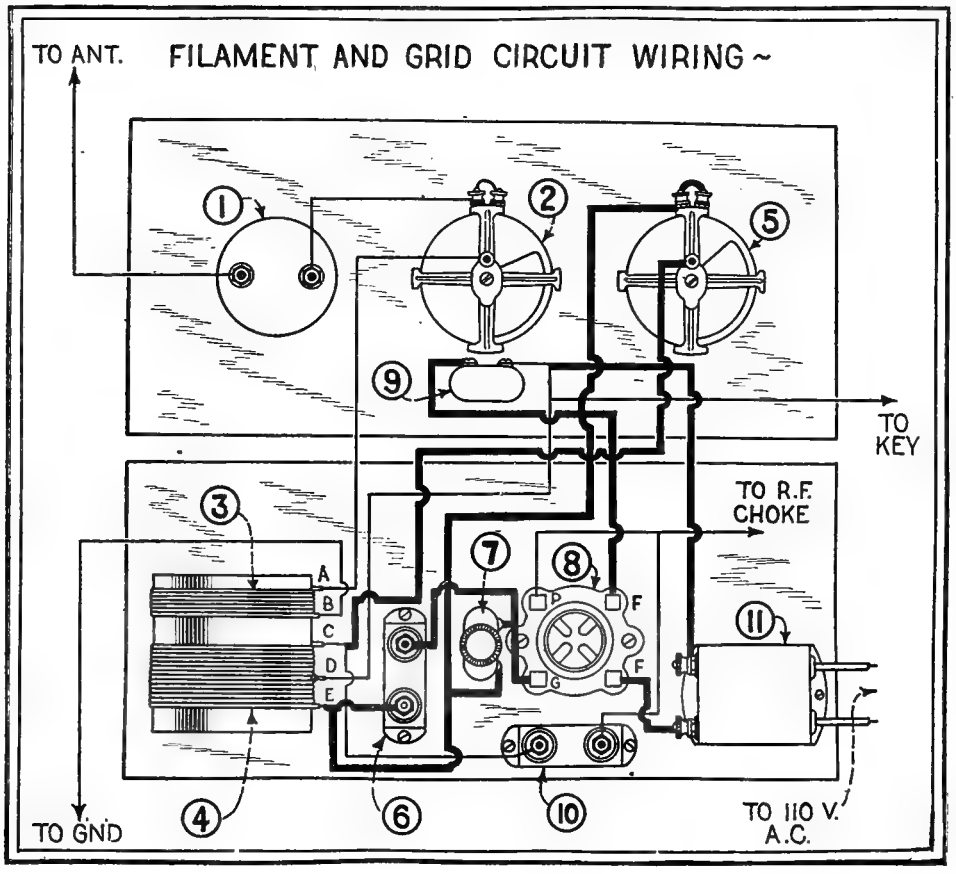


ped for future experimental work. The ratings of these instruments for general use up to 50 watts power should be as follows. Antenna ammeter, 0 to 2. Filament voltmeter, 0 to 15. Plate milliammeter, 0 to 200. If you get good instruments such as the antenna ammeter illustrated, they will give good readings even at the lowest parts of their scales which points, by the way, will be used with a set of the type illustrated.

VACUUM TUBES

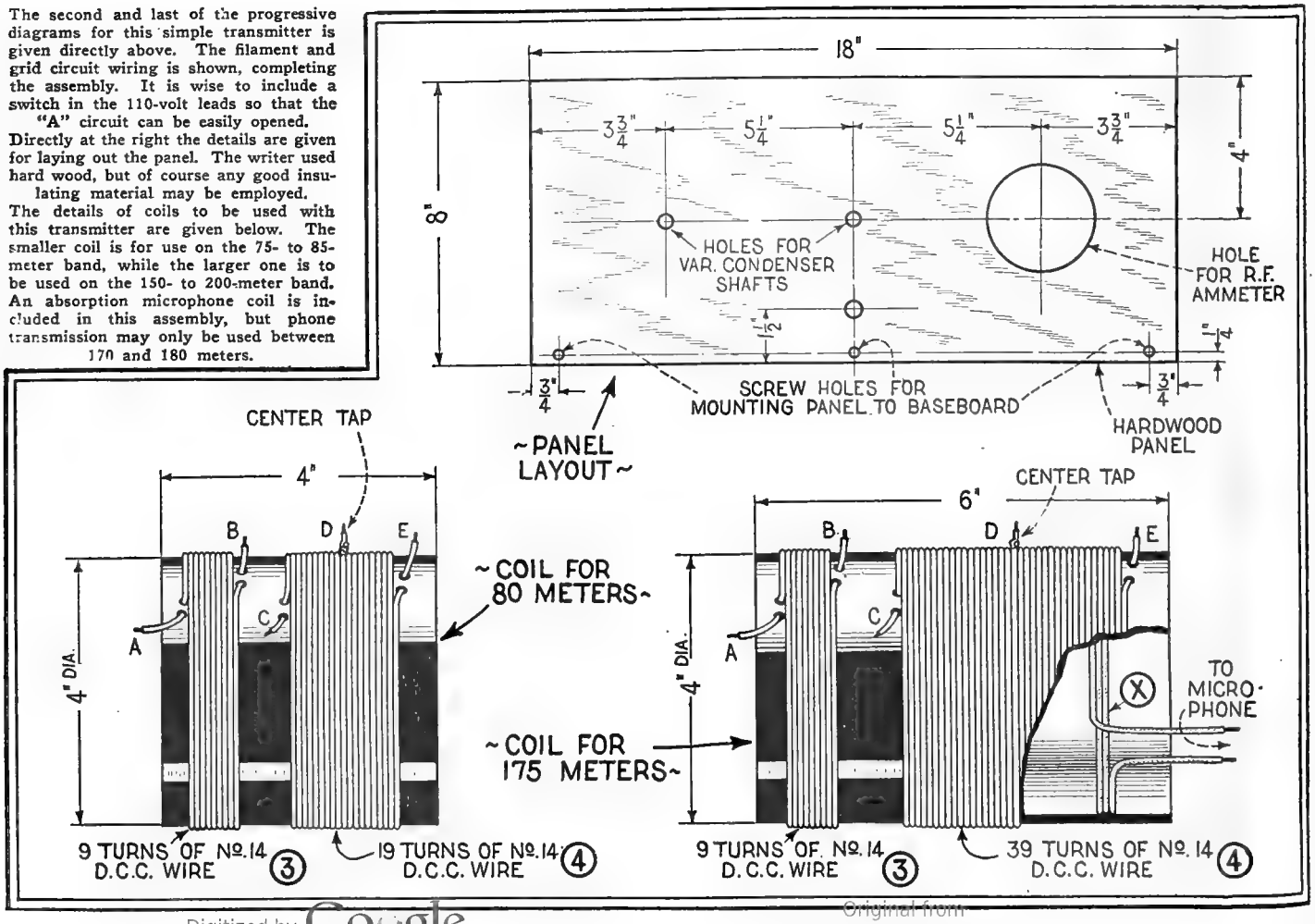
This set has been designed to operate with a UV-201A tube. Properly constructed and operated it will give excellent results. The filament step-down transformer should be of a type that will supply at least one-quarter of an ampere to the tube. The one used in the writer's set had three voltage taps on the secondary; one for 6, one for 12 and one for 18 volts. This is not necessary in a set of this type and the transformer was used only because it happened to be the only one on hand at the time.

The antenna for use on both 80 and 175 meters should be about 60 feet long over all and at least 30 feet high. The lead-in and antenna should both be extremely well insulated. Exercise great care here as any expense incurred in buying good insulators will amply repay you in results obtained.

A transmitter can be used with a ground connection in just the same manner as a ground is used on a receiving set. However, a perfect ground is hard to obtain and a poor ground used in connection with a transmitter will be a decided drawback. Therefore, the average amateur station uses what is known as a counterpoise. This usually

(*Continued on page* 589)

The second and last of the progressive diagrams for this simple transmitter is given directly above. The filament and grid circuit wiring is shown, completing the assembly. It is wise to include a switch in the 110-volt leads so that the "A" circuit can be easily opened. Directly at the right the details are given for laying out the panel. The writer used hard wood, but of course any good insulating material may be employed. The details of coils to be used with this transmitter are given below. The smaller coil is for use on the 75- to 85-meter band, while the larger one is to be used on the 150- to 200-meter band. An absorption microphone coil is included in this assembly, but phone transmission may only be used between 170 and 180 meters.



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RADIO ORACLE

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this Department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.

SEPARATE "A" BATTERIES

(390) Q. 1. Milton Bausch, Hartford, Conn., asks if there is any advantage in using "A" batteries for the various tubes in a multi-tube set.

A. 1. Of late, practically every circuit shown in various periodicals uses a common "A" battery. This is done in order to conserve batteries and is a relic of the days when tubes drew quite a considerable amount of current for heating the filaments and therefore a storage battery was necessary for this work. As a consequence, circuits were designed to use one battery to operate all tubes. However, it is quite well known that the results noticed would be somewhat better if separate batteries were used for lighting the filaments of each tube. The advent of vacuum tubes operating with a single dry cell for lighting the filament has made this use possible and we are reproducing herewith a diagram of a five-tube set using separate "A" batteries. If you employ tubes of the WD-12 type you need use only one dry cell for each tube. Separate rheostats are shown, but so as to reduce the number of controls, fixed filament resistances can be used in place of those rheostats controlling the radio frequency and audio frequency amplifying tubes. However, an adjustable resistance or a rheostat should be used in the filament circuit of the detector tube.

In order to still further aid the good work, a separate "B" battery should be used for the detector tube and therefore the necessary connections for this work are shown.

ELIMINATING INTERFERENCE

(391) Q. 1. Chas. Barker, Jr., Venus, Texas, says that he has considerable trouble due to a buzzing noise in his radio receiving set which emanates from a ringing machine used by a local telephone company. He asks how this trouble can be eliminated.

A. 1. There are two appliances getting rid of or reducing the buzz you mention; the first one is installed by the telephone company, reducing interference in all sets, and the second one is to be applied to each receiving set.

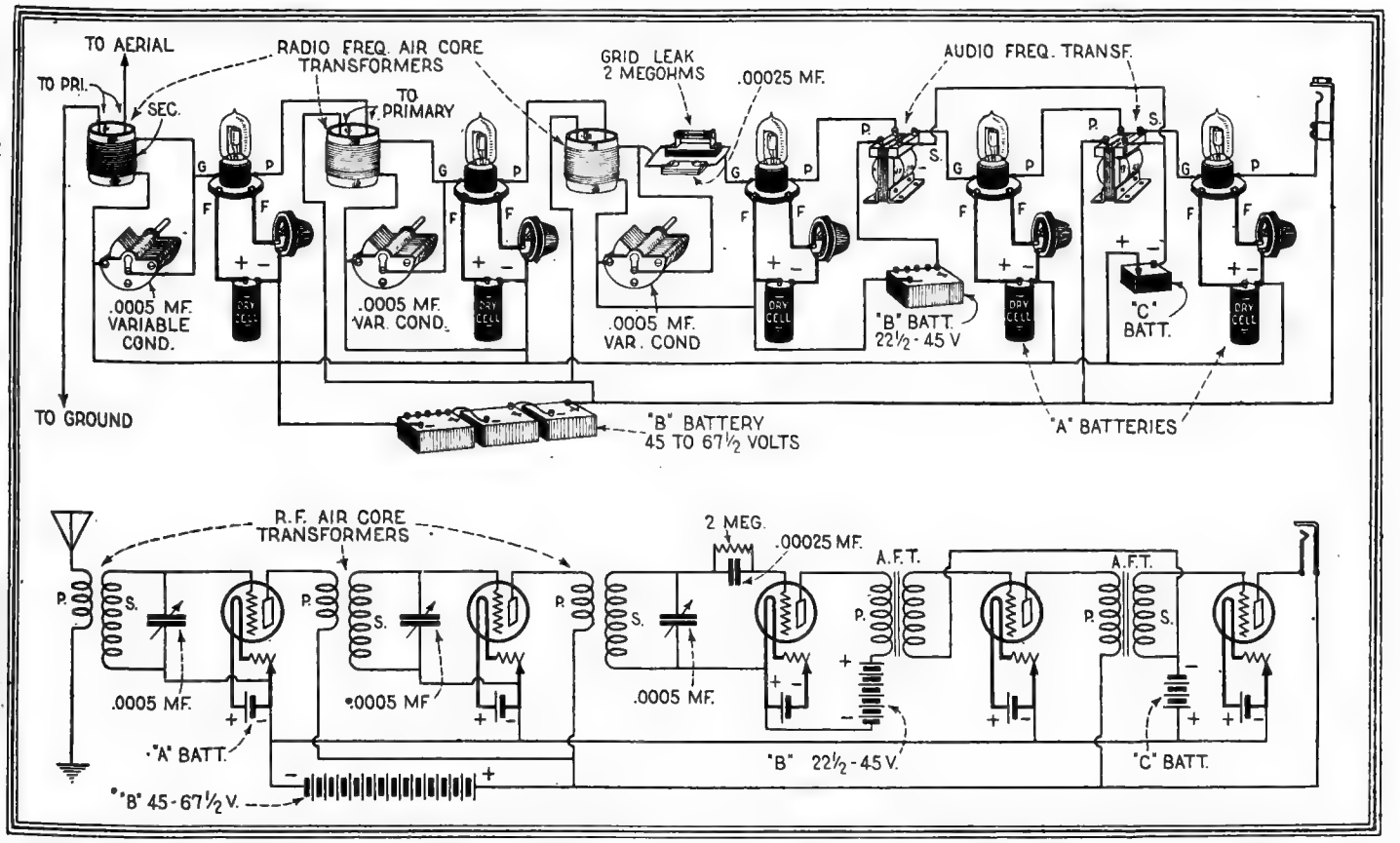
In order to use the first method it will be necessary for you to get in touch with the manager of the local telephone company and take up the matter with him. It will be necessary for them to insert in their circuit a filter composed of chokes and condensers which will have to be designed especially for that installation. If they are not willing to do this, your next resort is to your receiving set itself.

Here it is necessary to use a filter system consisting of a choke coil and a .001 mf. variable condenser. These two are connected in parallel and are connected directly from the aerial to the ground of your set. The size of the choke coil will have to be determined by experiment and as a starter we would suggest the use of about three layers of No. 20 D.C.C. wire on a core of iron wires, one-half inch in diameter by four inches long.

SELECTIVITY

(392) Q. 1. Robert M. Crotty, Syracuse, New York, says that he has a standard three-circuit tuner, but desires to get better selectivity with it with absolutely no decrease in volume and without the addition of more tubes.

A. 1. With the set you have at present, it is almost impossible to fulfill all of your requirements. You can make the same more selective, but there is a possibility that your volume may be slightly decreased. We would suggest, however, that you make the changes mentioned below and put up with the lesser volume as selectivity is usually far more to be desired than a quantity of volume. Since you say that your aerial is 125 feet long over all, we would advise you to cut it down so as not to exceed 80 feet over all. This will undoubtedly increase your selectivity greatly. If the secondary of your coil is wound with comparatively small wire, we would advise you to rewind it, using the same number of turns but using wire at least as large as No. 20.



(Q. 390) When using dry cell tubes, one "A" cell can very readily be used for each tube. Use either separate rheostats or fixed resistances in the amplifier filament circuits. Many experimenters report excellent results with the system as shown with all filaments and batteries in parallel.

WANTED!!! RADIO ARTICLES

WE want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketches of the hook-ups or mechanical details, et cetera. We are particularly desirous of obtaining new hook-ups and descriptions of single tube sets, reflex and other types which have proven satisfactory. We like articles on new single tube receptors. We will pay good prices for your ideas. —Editor.

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TWO-TUBE REFLEX

(393) Q. 1. D. Vender, Los Angeles, Calif., wants to use honeycomb coils in an efficient type of reflex circuit and asks us to show the connections for a set of this nature.

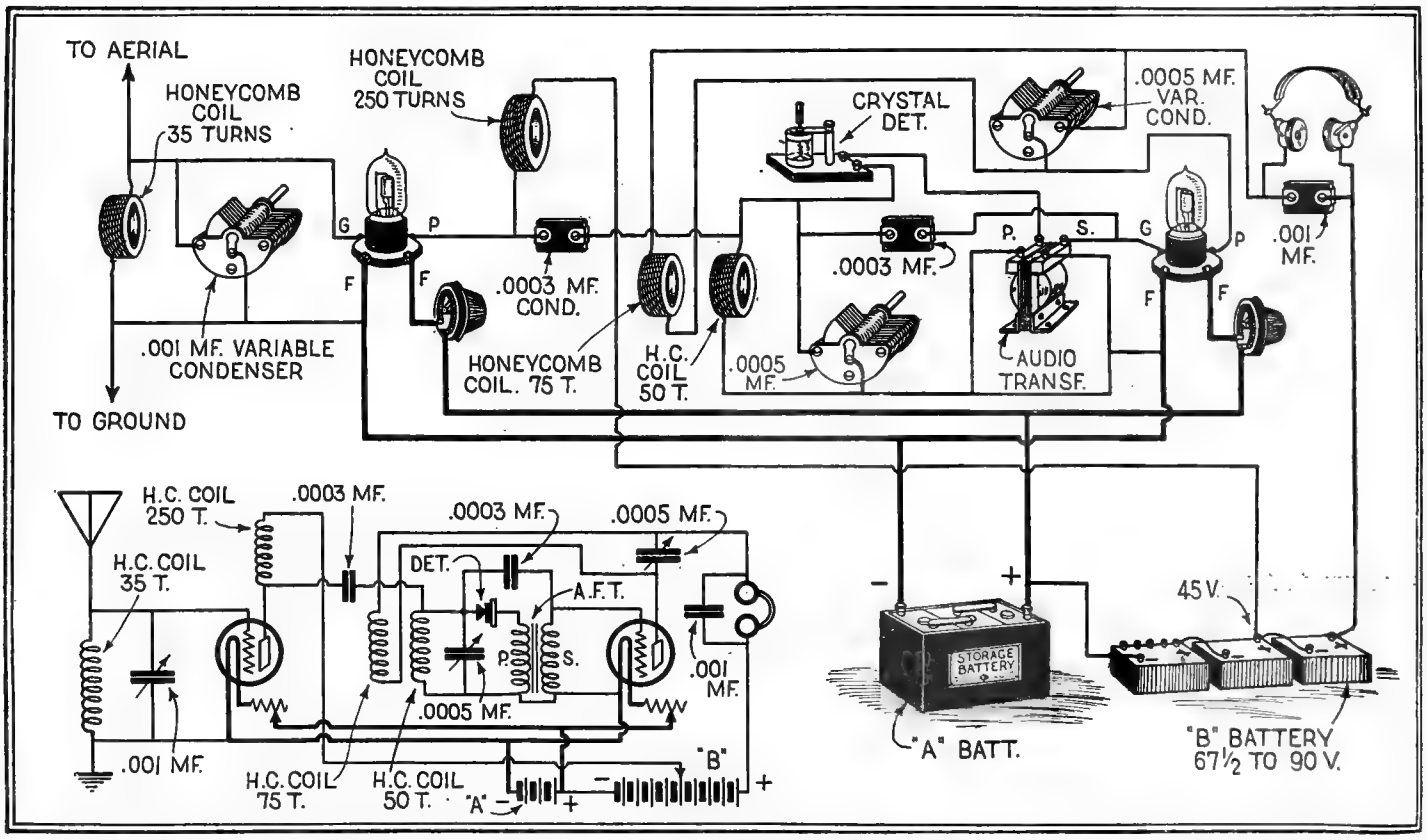
A. 1. Probably the best circuit for you to use is that reproduced here. If desired, the antenna coil, the plate coil of the first

A. 1. The phenomena you mention might readily be attributed to excessive atmospheric electricity. If the sparks you mention occurred during a snow storm, the cause can be attributed thereto. It has been noticed very often that what is known as *snow static* accumulates on the antenna and discharges through the receiving set to the ground.

able radiation. Also, the voltage drop in the rectifier would be so great that we do not believe you could even get your transmitter to oscillate.

Q. 2. How can an automobile spark coil be used as a modulation transformer? The coil referred to is of the three-terminal type.

A. 2. In order to use your spark coil as



(Q. 393) Many experimenters seem to always be desirous of trying out something new in reflex circuits. Here is one that will keep you busy for some time. It is of English origin and using honeycomb coils throughout, will give good results when properly operated.

tube and the plate coil of the second tube may all be coupled together, giving a double regeneration effect which, when properly balanced and tuned, will give astonishing results. The circuit which we show is one that is very popular in England and is known as a 2-tube Trinadyne circuit. The choke coil, a honeycomb coil, helps to stabilize the circuit.

COATED FILAMENTS

(394) Q. 1. H. Calamess, Van Nuys, P. O., Calif., asks how the so-called coated filaments are made and of what they consist.

A. 1. The coated filaments in vacuum tubes consist of the tungsten wire which becomes incandescent upon the passage of an electrical current, which has been treated with a thorium compound, which forms successively films of oxide which, when subjected to the heat generated by the central core, increase the electronic stream discharged from the filament toward the plate, thereby rendering the tube more efficient in operation. The exact composition of the "coating" of these filaments is not available for publication.

ATMOSPHERIC ELECTRICITY

(395) Q. 1. John W. Capwell, Newark, N. Y., says that one day his attention was attracted to his radio set by a crackling noise. Investigation showed a spark about $\frac{1}{16}$ of an inch long jumping across the antenna tuning condenser. What was the cause of this phenomenon which happened in the middle of last winter?

TWO ELEMENT TUBE

(396) Q. 1. Joseph G. Bartos, Dayton, Ohio, asks us to outline the advantages and disadvantages of employing a two-element vacuum tube in place of a crystal detector in a reflex circuit.

A. 1. The greatest advantage of such a change is that the two-element tube is very stable in operation and does not require the frequent adjustments that a crystal does. As to volume and selectivity, we would advise that there is possibly a slight margin in favor of the tube as a detector.

The principal disadvantage in using a tube detector is that a greater filament and plate consumption is required for the entire set and consequently the batteries must be replaced or recharged more frequently with the tube detect - than with the crystal. However, this is the only noticeable disadvantage and the clarity and tone with either detector will be very good. We believe that you will obtain greater satisfaction from your set if the tube is used.

TRANSMITTING QUERIES

(397) Q. 1. Alfred B. Anderson, Procter, Vt., sends us a circuit diagram of a standard transmitter using a combination filament and a plate transformer. He asks if he can eliminate all power transformers by using a storage "A" battery to heat the filament and by connecting the A.C. directly to the rectifier.

A. 1. You would not be able to eliminate the transformer in the circuit as you mention, because you would not be applying enough potential to the plate to get appreci-

a modulation transformer, you should take the case off the same and separate the connections so that you obtain two primary and two secondary leads. These can be hooked up in the conventional manner.

Q. 3. How can my radio set be used as a C.W. transmitter? In other words, where should the key be connected?

A. 3. To use this set as a C.W. transmitter, place the key in series with the plate supply. This key is to be closed when transmitting by radiophone.

WAVE-METER QUERY

(398) Q. 1. J. K. Woods, Dallas, Texas, says that he has a calibrated wavemeter but that it is not equipped with a driver and desires to know whether or not it can be used for checking the wave-length of a station that is being received on an ordinary regenerative tuner.

A. 1. This work is quite possible and is rather simple. Tune in the station to its greatest volume and then place the set in oscillation. Place the wave-meter coil near the secondary circuit and vary the condenser slowly. Two clicks will be heard in the receivers, the clicks being about two degrees apart on the wave-meter dial. Now, move the wave-meter further away from the receiver by 2 or 3 inches and try again. This time the clicks will be closer together. Keep doing this, moving the wave-meter only a short distance at a time until the two clicks are so close together that they sound as one. This point will be the desired one and from it you can find the wave-length of the station being received.

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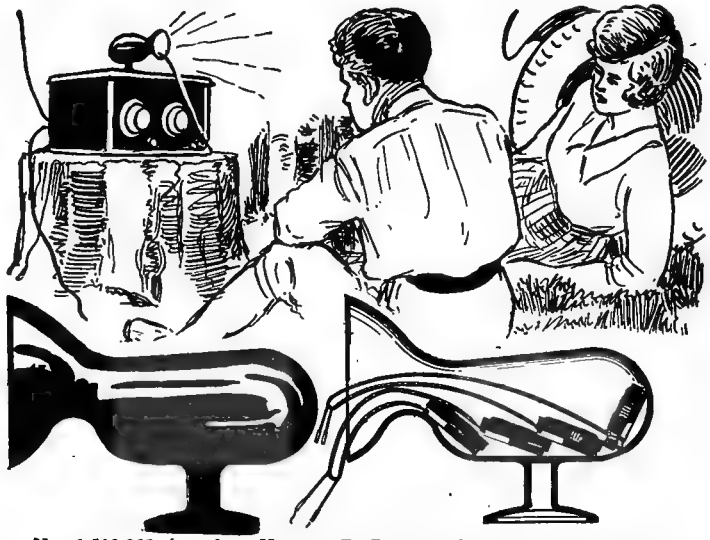
LATEST PATENTS

Auxiliary Hoe Handle

No. 1,534,075 issued to Washington B. Parrish should be of great interest to all of those who have occasion to use hoes, rakes, shovels or implements of similar nature. Mr. Parrish has devised an auxiliary handle to be attached to any one of these devices and which, it is said, will make the task of handling them very much easier. This separate handle is clamped to the shaft of the implement in the manner shown and is provided with a wing nut which, upon being loosened, allows the handle to be turned to any desired position. When this has been accomplished, one hand of the user grasps the auxiliary handle as shown above, while the other hand is placed on the shaft. In this way the device can be manipulated in a manner that is much less tiring to the user than the usual method.

Portable Loud Speaker



No. 1,538,865, issued to Herman P. Porter, relates to a portable loud speaker or amplifier to be used in connection with small compact radio receiving sets that are designed for outdoor or portable use. The device, in essence, consists of a sound chamber shaped in a general manner as shown above. One or more pairs of headphones are to be placed within the chamber as indicated and are to be connected to the radio receiving set in the usual manner. The sounds emanating from the phones placed within this chamber are deflected toward the throat whereupon they emerge from the outwardly flaring portion clearly and with their natural tones. It is said that all extraneous and unnatural sounds are eliminated. Mr. Porter has also covered various other designs of this device in his patent. They will hold from one to four phones.

Ash Receptacle

No. 1,511,217, issued to Herbert E. Floercky, protects a novel type of combination match box holder and ash receptacle that is designed to clamp on the arm of a chair or in any other convenient position. The device is illustrated in detail and in use above. The receptacle portion is removable to facilitate quick and easy cleaning. Jaws are provided directly above the ash tray in which a cigarette or cigar can be placed. When this is done, any ashes falling from the cigarette or cigar will be deposited directly in the ash tray, thus saving the floor and rugs. The box of matches is very handy to the user.

Pastry Server

No. 1,538,808, issued to Arthur Hedeen, provides protection for a combination server of the type illustrated above. This device takes the form of a combined knife and two tined fork. The knife is used to cut cake or pie whereupon when it is inserted under the piece of pastry in the usual manner the tines engage with the pastry and steady it. Mr. Hedeen has also obtained protection on an attachment by means of which an ordinary cake knife can be made of the same type as that shown.

Tooth Brush

No. 1,537,467, issued to Arthur G. Ingle, describes a new type of folding toothbrush designed especially for the use of the traveler. Usually, one who literally lives in a suitcase has quite some trouble with that one particular item of personal use that really requires the best of care—the toothbrush. In order to keep this device clean, Mr. Ingle has provided a handle into which the brush folds when it is not in use, assuming the appearance and size shown directly above. A hinge is so arranged that the brush will only open straight and will not fold backward.

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$28,000.00

OFFERED BY

SCIENCE and INVENTION Magazine

$11,000.00 in Prizes for Psychical Phenomena

Well, we are still waiting for the General Assembly of Spiritualists of the State of New York to accept our challenge which we published in the September issue of this magazine. You see, the General Assembly, in a small pamphlet challenged any trickster to produce psychical manifestations such as they are capable of doing without the aid of trickery, and we have requested that they produce those manifestations in our presence, and if they do so also without the aid of trickery, we will let them in on some easy money.

When any organization of spiritualists or when any medium claims to be able to produce writing on the inside of sealed slates, or when they claim they can levitate ponderable bodies without application of physical or mechanical force, or when they claim they can produce independent voices, we automatically want to be shown, and are willing to pay a total of $11,000.00 for a private performance. Tell your own favorite medium about this if you have one.

$5,000.00 in Prizes for Perpetual Motion

No one has as yet come to claim the $5,000.00 for a perpetual motion machine at which the editors of SCIENCE & INVENTION Magazine are desirous of looking. So many perpetual motion ideas have been submitted to the editors of this publication, each with the statement that "the machine actually works, but why should I devulge the secret when I will get nothing for it," that we decided more than two years ago to pay $5,000.00 to anyone who will merely exhibit a working model of a perpetual motion machine. Machines working by evaporation, tides, winds or waterfalls cannot of course be classed as perpetual motion devices. No photographs or diagrams can be entered into this contest, but the working model must either be brought or shipped to the offices of this publication. We do not desire the rights to the invention and make this award merely for the protection of investors in machines which have no scientific background of reasoning upon which the inventors could base their claims. Meanwhile don't invest in a perpetual motion proposition—you can't win.

$1000.00 Monthly Contest Awards

FIRST PRIZE $100.00

Characteristics of Organic Glass, by Ismar Ginsberg, B.Sc., Chem. Eng. 520-521

SECOND PRIZE $75.00

Spiderwebs as Fishing Nets, by Dr. E. W. Gudger 512

TWO PRIZES OF $50.00 EACH

Tricks of Mediums, by Rev. Crawford Trotter 501
Reversed Astronomy, by Isabel M. Lewis, M.A. 522-523

THREE PRIZES OF $35.00 EACH

The Sun—World's Greatest Engine, by Donald H. Menzel 507
Building the Motor Hoop, by John Galen Barber 534-535
Hints to the Radio Builder, by Leon L. Adelman 545

FIVE PRIZES OF $25.00 EACH

Our Wood Supply, by Sam Brown 511
Boat for Shallow Water, by C. Kout Vlastimil 514
The Earth's Surface is Shifting, by Donald H. Menzel 515
California's "Magnetic Hill" Myth, by Edwin H. Schallert 531
Helpful Laboratory Hints, by Raymond B. Wailes 533

FIVE PRIZES OF $20.00 EACH

Nature, Producer of Electricity, by Don Home 509
Rescuing Device for Divers, by Dr. Albert Neuburger 521
Cross-Number Puzzle, by Richard Hoadley Tingley 527
Scroll Saw from Sewing Machine, by Harold Jackson, Rep. No. 2903... 532
Radio Controlled Ship, by Harold T. Wilkins 542

TEN PRIZES OF $15.00 EACH

Hunter's Hat. Author please send address 514
Wire Former, by H. N. Whitmore 519
Magic Painting, by C. A. Oldroyd, Rep. No. 4433 523
Renovating Furniture, by S. Goehns 523
Gas Tank Filler, by John B. Roswick 530
Magnetic Pick-up, by Allen P. Child 530
Imitating Carved Wood, by Dr. Ernest Bade 532
Lathe. Author please send address 532
Furnace, by E. C. Zimmerman 536
Tuning Aid, by Frank M. Blackwell 544

FIFTEEN PRIZES OF $10.00 EACH

Milk Bottle Holder, by J. B. Roswick 519
Tonsorial Aid, by Murray Schick 519
Magnifier, by George C. Hoheim 519
Lamp Lock, by H. Klein 519
Auto Compass, by C. G. Percival 530
Car Ventilator, by C. G. Percival 530
Handle Light, by C. G. Percival 530
Spark Plug Wrench, by Allen P. Child 530
Rivets, by Walter T. Markowski, Rep. No. 192 536
Static Generator, by H. S. Fox, Rep. No. 5439 536
Tee Square, by C. A. Oldroyd, Rep. No. 4433 536
Air Pump, by C. A. Oldroyd, Rep. No. 4433 536
Varnish, by A. A. Blumenfeld 538
Hydrometer Holder, by George A. Coates, Rep. No. 12052..... 538
Hand Soap, by Enrique Corral 538

TEN PRIZES OF $5.00 EACH

Riveting Hints, by Pan, Rep. No. 6535..... 536
Cleaning Bottles, by N. Greenspan 538
Eye Shield, by E. Zimmer 538
Leather Polish, by Peter Gudes, Rep. No. 21320 538
No-Glare Bulb, by P. Boissineau, Rep. No. 502 538
Cork Remover, by Arthur Kern 538

(No further entries)

Other Pending Contests

Thirty Combination Pen-Pencils Awarded as Prizes in the Clock Spring Contest. Contest announced in the August issue and closes October 1, 1925.

$250.00 in Prizes Awarded for the Best Methods for Exterminating Rats. Contest Announced in the July Issue and Closes Noon, October 15, 1925.

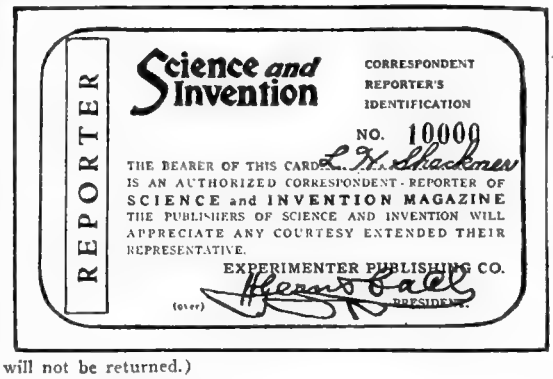
$12,000.00 in Prizes for Articles

82 monthly prizes will be given as follows:

FIRST PRIZE		$100.00	
SECOND PRIZE		$75.00	
2	PRIZES OF	$50.00	each
3	" "	35.00	"
5	" "	25.00	"
5	" "	20.00	"
10	" "	15.00	"
15	" "	10.00	"
10	" "	5.00	"
15	" "	2.00	"
15	" "	1.00	"

Last year SCIENCE AND INVENTION Magazine paid for articles $13,320.00 to 1,112 prize winners. Hundreds of SCIENCE AND INVENTION reporters won prizes, and up to the time of going to press there were more than 27,000 reporters in the field.

Every month this publication pays $1,000.00 or more in prizes, exclusive of money paid to those authors who are on contract, and who receive their own rates. At the left the list of prizes issued monthly is itemized, and above are the names of the prize winners for this issue. In order to assist our reporter correspondents in securing available material for publication, we issue without charge the reporter's card, a sample of which is illustrated at the right. Send a postal card for one. It will act as an open sesame in securing news. Address Field Editor, SCIENCE AND INVENTION, 53 Park Place, New York City.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Scientific Humor

SOUNDS LIKE A SPEAK EASY

MEDIUM: "I have called the spirit three times. She moves, she makes signs, but she doesn't speak."

WIDOWER: "She doesn't speak? Well, that can't be my wife, then."—*Smith O'Brien.*

A WELL SHIELDED SET

It had been noticed that a resident of Los Angeles has placed an order with a local undertaker for a $1,200 steel coffin equipped with a radio receiving set.

Well, anyway, he'll have a good "ground!"—*Margery Hewitt.*

HE MOVED FAST

MEDICINE SALESMAN: "And ladies and gentlemen:

"I have sold over one million bottles of this great Mexican remedy and never had a complaint. I ask you, what does this prove?"

VOICE FROM CROWD: "That dead men tell no tales."—*Bill Doll.*

STEAMSHIPS NOT ALLOWED

LECTURER (lecturing on methods of transportation): "Now the best method of transportation we have today is——"

FAT MAN IN AUDIENCE: "The alimentary canal!"—*Paul Good.*

(R)EVOLUTIONARY

Darwin was on a railway journey in England and was taking a monkey with him. The ticket agent insisted that he buy the monkey a dog ticket. Darwin insisted that it was not a dog, and to clinch his argument pulled a tortoise from his pocket and said, "I suppose this is also a dog?" The ticket agent replied, "No, sir, monkeys is dogs, but tortoises is hinsects."—*C. W. Leonard, Jr.*

A FOWL RUSE

HI: "Ever try radio music to make your hens lay, Si?"

SI: "No, but I once let them listen to a lecture on how to kill and dress poultry for the market, and every hen has laid an egg a day ever since."—*John Spicer.*

AUNTIE DATED IT

"Yes," declared the guide, "this papyrus was written in 3496 B. C."

"How did they know that?" asked the skeptical tourist.

"The date was on it."—*J. Samachson.*

THIS IS OUR EXPLANATION

FLUB: "What's the heaviest planet?"

DUB: "Mercury, of course."—*E. A. Daansen,* Reporter No. 17,657.

AND TIN CANS

PHYSICS PROF: "Kindly indicate some of the properties of the metals."

JUNK DEALER'S SON: "Lead sinks, copper coils, gold rings, brass bowls.—*E. A. Daansen,* Reporter No. 17,657.

FIRST PRIZE $3.00

WANTED TO MAKE SURE

The electrician was puzzled. "Hi, Sparks!" he called to his youthful assistant, "put your hand on one of these wires."

Sparks did as he was told.

"Feel anything?"

"No," replied Sparks.

"Good!" said the electrician. "I wasn't sure which was which. Don't touch the other wire or you will be electrocuted."—*John H. Varley, Reporter No.* 19629.

IT ALSO MAKES GAS-SO-LEAN

HISTORY PROF.: Can any of you tell me what makes the Tower of Pisa lean?

CORPULENT IDA: I don't know, or I'd take some myself.—*M. Bercovitch, Reporter No.* 21358.

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best jokes submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

NOW WHAT IS THE MATTER?

The air bellows
The brake drums
The piston rings
The fuse blows
The tool rests
The spark coils.—*Herbert Gross.*

UP A TREE

CARPENTER: "Say, you are a regular supporter of the Darwin theory."

APPRENTICE: "Why do you call me a supporter of the Darwin theory?"

CARPENTER: "Because you are always monkeying with something."—*Leland Ray.*

SHOCKING

DINTY: "Jim shoved the end of a thousand volt wire down Bill's throat."

DUGAN: "How did it affect Bill?"

DINTY: "It made him hot under the collar."—*T. T. Rose.*

DUMBELLS ARE EVENLY BALANCED

PHYSICS PROF: "What is the center of gravity?"

BRIGHT STUDE: "The letter V."—*B. Meigs.*

INHERITED

DOCTOR (at clinic quiz): "How can the patient be suffering from an inherited and occupational disease when he has the sleeping sickness?

STUDENT: He says his father was a night watchman.—*J. J. O'Connell.*

GOOD HE DIDN'T COME OUT OF A MINE

JUDGE: "What name?"

HUMOROUS AVIATOR: "Angel, sir."

JUDGE: "Where did you come from?"

AVIATOR: "Heaven, sir."

JUDGE: "Well!! How did you get here?"

AVIATOR: "Slid down a rainbow, sir."

JUDGE (grimly): "Well, take six months for skylarking."—*Stanley R. Russell.*

OF ORANGES—JUICE

QUESTION: "What are the constituents of quartz?"

BRIGHT STUDENT: "Pints."—*Adelbert Body,* Reporter No. 18,360.

THIS JOKE IS THAT OLD

ANTIQUARIAN: "Just think, those ruins are 2,000 years old."

WISE GUY: "Aw, gwan, it's only 1925 now." —*Henry B. Davenport.*

IMPRACTICAL THEORY

MRS. BILL: "Why do you speak of your husband as a theory?"

MRS. JACK: "Because he so seldom works."—*Henry B. Davenport.*

USE HONEYCOMBS

FIRST RADIO FAN: "I'm very puzzled over this new receiving set."

SECOND FAN: "Why!"

FIRST FAN: "I can't decide what kind of bait to put on the wave-trap.—*Richard Doan, Reporter No.* 22305.

THE SHORT AND LONG OF IT

"Your English language, it is absurd. The words are so short," observed the visiting Russian.

"That's right," agreed his American friend. Then, turning to another American in the party, "Did you get that 27-letter word meaning 'A disease of the lower limbs?'"

"Yes, it was 'Elephantiosmagnatisemalosis.' Did you get your 30-letter word for 'a substitute for hard rubber?'"

"Yea. 'Oxybenzolmetholphenolanhydride.'"
—*Thomas Badger.*

A DE-VOID JOKE

Some men get something for nothing—the vacuum in their radio tubes.—*Harold Kennedy.*

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THE ORACLE

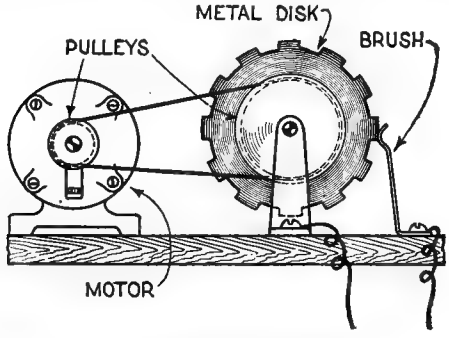
The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculations, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

CIRCUIT BREAKER

(1910) Q. 1. Douglass Thomas, Portland, Ore., asks how current can be applied intermittently to one magnet or how it can be distributed periodically between two magnets.

A. 1. Probably the best and simplest method of accomplishing this work is to use a rotary circuit breaker of the simple type illustrated herewith. This consists of a metal disk cut as shown, supported by suitable bearings and driven by a motor. A reducing gear arrangement such as illustrated may be used and should be so designed as to drive the metal disk at the required speed.



An excellent type of circuit breaker for experimental use is shown above.

If it is desired to distribute the current intermittently between two magnets, two disks may be employed having a common connection between them and the two brushes may then be connected to the two magnets. The connection between the two metal disks and a common wire connecting the two electro-magnets are then led to the source of current.

KEROSENE AS CARBON REMOVER

(1911) Q. 1. W. R. Bishop, Kalamazoo, Mich., asks whether or not we have ever heard that the use of kerosene for eliminating carbon in a gasoline engine can do damage to the engine.

A. 1. We do not have any record on hand of injury ever having been done to any gasoline engine by the use of kerosene for eliminating carbon. Too much will be apt to deposit soot or lampblack in the cylinder.

Q. 2. Can kerosene be used to prevent the formation of carbon in a gasoline engine?

A. 2. Kerosene cannot be used to prevent carbon from accumulating. It is only used to remove it.

IMITATION JEWELS

(1912) Q. 1. A. C. Boldt, St. Paul, Minn., asks how the metallic backing on imitation jewels is produced.

A. 1. The process of placing a metallic foil coating on the back of an imitation jewel is sometimes done by a plating process. This may be done as follows:

First, clean thoroughly the surface to be plated, which may be done by washing first with an alkali and then with distilled water.

Next, dissolve 7.8 grams of silver nitrate in 60 c.c. of water and divide the solution in two equal parts. In a separate vessel, dissolve 3.11 grams of Rochelle salt in 1,180 c.c. of water and boil the solution. Add to it gradually so as not to stop the boiling one of the portions of the silver solution; boil for 10 minutes longer, allow to cool and then decant the clear liquid.

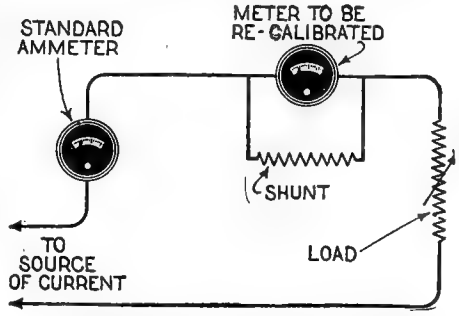
To the other half of the silver solution add sufficient ammonia water to dissolve the precipitate which is formed, or until only a faint cloudiness is left, then add 36 c.c. of water and filter. Mix equal portions of these two solutions and suspend the imitation jewels therein, first covering the portion which is not to be plated with wax. A brilliant coating of silver will be formed in about 10 minutes. The plated surface should then be washed, dried and varnished.

Bright metallic foil is also used. That is a very old system.

AMMETER CALIBRATION

(1913) Q. 1. Raymond Smith, Long Island, N. Y., asks how he can increase the range of a standard ammeter which he has in his possession.

A. 1. Unless you have facilities at hand for the measurement of resistances, you should use the system illustrated herewith and described below. To make the ammeter pass more current, a shunt is placed across it as indicated. This shunt consists of a resistance of such a size that it will enable the split circuit formed by itself and the ammeter to carry the required amount of current. For instance, if a shunt whose resistance is equal to that of an ammeter is used, twice as much current will be passed through the circuit, and for a given amount of current the ammeter will read only one-half as much as it would without the shunt. Of course, these resistances cannot be determined without measuring instruments and therefore a cut and try method is to be recommended. This consists of using a standard calibrated ammeter which will cover the range that it is desired to cover with the other meter after it is recalibrated. The instruments are all hooked up as shown in the accompanying diagram. The load may consist of a lamp bank or a variable resistance so that varying loads can be applied to the entire circuit. Make up an experimental shunt, being sure that the wire is large enough to pass the required amount of current. Connect up the circuit as shown and turn on the current. The reading on the standard ammeter will be equivalent to the amount of current flowing in the circuit. Mark this point on the dial of the meter being recalibrated. Vary the load resistance and mark the new point so located on the meter to be changed. In this way, several points can be determined and quite accurate results may be had. If two or three shunts are made up, a corresponding number of scales can be made for the ammeter and thus the use of the instrument will be greatly increased.



An ammeter may be recalibrated for larger loads by using the above circuit.

SOLDERING CAST IRON

(1914) Q. 1. James Hayek, Chicago, Ill., asks for complete directions for the most practical way of soldering cast iron objects.

A. 1. The process consists in decarbonizing the surfaces of the cast iron to be soldered, the molten hard solder being at the same time brought into contact with the red-hot metallic surfaces. The admission of air, however, should be carefully guarded against. First pickle the surfaces of the pieces to be soldered, as usual, with acid and clamp the two pieces together. The place to be soldered is now covered with a metallic oxygen compound and any one of the customary fluxes are heated until red hot. The preparation best suited for this purpose is a paste made by intimately mingling together cuprous oxide and borax. The latter melts in soldering and protects the pickled surfaces as well as the cuprous oxide from oxidation through the action of the air. During the heating, the cuprous oxide imparts its oxygen to the carbon contained in the cast iron and burns it. Metallic copper separates in fine subdivision. Now apply hard solder to the place to be united, which, in melting, forms an alloy with the eliminated copper, the alloy combining with the decarbonized surfaces of the cast iron.

STEREOSCOPIC MOVIES

(1915) Q. 1. P. N. Peters, Brooklyn, N. Y., refers to an article on stereoscopic motion pictures published in a recent issue of this magazine wherein each alternate frame on the film is made from one of two different positions whereupon when the film is projected in the usual manner, a stereoscopic effect is produced. He says that he does not see how this method can possibly work and asks for further explanation.

A. 1. The stereoscopic motion picture method described depends upon the retention of vision by the human eye. Both of the eyes of the spectator are used. They first view the scene as recorded by the right-hand lens of the camera and then as by the left-hand lens. The effect is a relief photograph.

FAN MOTOR

(1916) Q. 1. C. H. Gaedtke, Prairie Du Chien, Wis., says that he has an A.C. fan motor with a squirrel cage type armature which will not start itself but must be started by hand and will run in either direction when this is done. He asks us our opinion on the trouble with this motor.

A. 1. The fan motor to which you refer is evidently of a centrifugal type and contact is not firmly established when attempting to start the same. Perhaps no starting device is provided.

RECLAIMING METALS

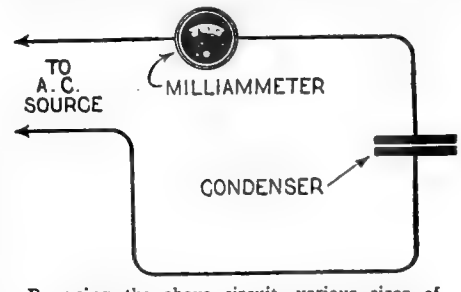
(1917) Q. 1. Melvin Beigland, Joice, Iowa, asks how gold and silver on plated articles may be reclaimed.

A. 1. The reclamation of gold and silver from gold- and silver-plated articles is not always a paying proposition, unless the percentage of the valuable metals is high. It consists, in essence, of cutting up the objects, if large, and dissolving the metals by means of sulphuric or nitric acid. The gold will remain undissolved and is collected by decantation. Silver dissolves and is precipitated by salt as silver chloride. This is reduced to the metallic state by treatment with scrap zinc and sulphuric acid. If lead is present, use nitric acid for first solution.

TESTING CONDENSERS

(1918) Q. 1. Lewis Campbell, Apollo, Pa., says that he has several condensers on hand and would like to determine the relative capacities of them in a rough way. He asks how this can be done without expensive and elaborate apparatus, inasmuch as great accuracy is not required.

A. 1. Probably the simplest method for you to pursue is that described below and illustrated in these columns. A milliammeter and one of the condensers are connected in series as shown. They are also connected to a source of alternating current. When the switch is closed or the current is turned on, the milliammeter will give a certain reading. If now a different condenser is substituted for the first one, the milliammeter reading may change. If it comes back to the same as it was first, the condenser is of the same capacity as the original one. If the reading on the milliammeter is lower, the capacity of the condenser is smaller. Likewise a higher reading indicates a larger capacity. It must be remembered that this method of comparing condensers is very rough and inaccurate. However, for your purpose we believe that it will be amply sufficient.



By using the above circuit, various sizes of fixed condensers can be compared.

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BEAUTY HINTS

(1919) Q. 1. M. J. Walsh, Hartford, Conn., asks various questions in regard to beauty and weight.

A. 1. Your various queries are summed up in the following paragraphs:

Beauty and weight are determined by the good health of the individual. By beauty we mean the preservation of the skin in its natural condition. Cleanliness and attention to the correct diet have more to do with the condition of the skin than all the beauty creams and other preparations manufactured.

As to steam baths, ice massages and hot and cold towels, we would say that the particular method to be used will depend upon the blemishes which it is desired to correct. In general, hot applications are used to open the pores of the skin so as to allow ready cleansing of the same. Such applications should under all conditions be followed by a cold application, which will cause the pores to close and prevent the individual from taking cold. Also, if the pores are left open after being treated with the hot application, it will be found that they very soon become enlarged and blackheads and other disfiguring eruptions appear.

As to massages and various creams, we would say that really the only practical value is that obtained from a cleansing cream which removes grime or dirt from the pores that cannot be taken out in other ways.

FREEZING EXPERIMENT

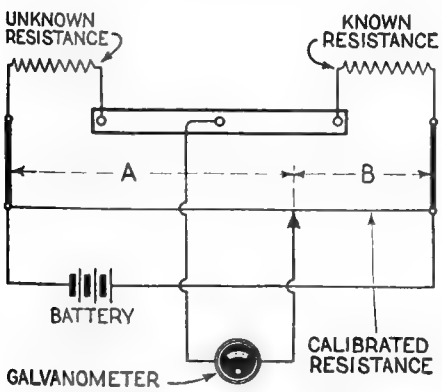
(1920) Q. 1. Howard R. Gutstein, Kendallville, Ind., says that he has been doing some experimental work in the production of cold by the evaporation of liquids and has been using ethyl chloride for this purpose. He asks us to suggest a substitute for this material.

A. 1. The only other easily obtainable material that will do the work you mention is ether. This, however, will only work under certain ideal conditions and to insure the success of your experiment we would advise you to use ethyl chloride.

WHEATSTONE SLIDE-WIRE BRIDGE

(1921) Q. 1. Wm. Villines, Rosedale, Okla., asks for some general information on the construction of a Wheatstone slide-wire bridge.

A. 1. We are giving the desired information below and reference may be had to the illustration of the bridge given in these columns. A battery is connected directly across a length of resistance wire which is equipped with a scale so that it is calibrated. When everything is connected as shown, a split circuit is made of which the galvanometer is a part. When the sliding contact on the calibrated resistance wire is at a point where each half of the split circuit is of the same resistance, there will be no deflection in the galvanometer. Then an equation can be



Unknown resistances can be measured by a Wheatstone slide-wire bridge of the type illustrated above.

made up by means of which un unknown resistance can be calculated by comparison with a known resistance. These units are shown in the diagram. Let K equal the known resistance and X the unknown resistance. Therefore, we can make the proportion that X is to K as A is to B. Since the values for A and B can be read directly from the scale and K is known, the resistance X can be quickly and easily calibrated.

COATING RUBBER

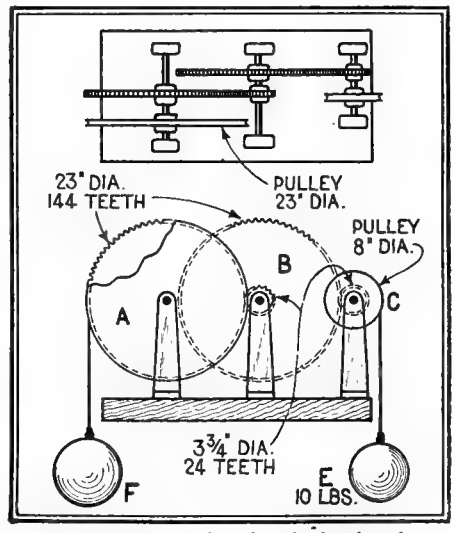
(1922) Q. 1. Erwin Herget, St. Louis, Mo., asks if we can tell him how to give rubber some kind of a coating that will make the rubber shine enough to reflect light, but still not affect its stretching.

A. 1. We do not have any record of any material which will coat rubber so as to make it shine enough to reflect light and still not affect its stretching. Well-cleaned rubber with the surface evenly covered with water will reflect light to a certain extent and may possibly be sufficient for your purposes. You do not say how much reflection you need and, therefore, we cannot answer you more definitely.

GEAR CALCULATIONS

(1923) Q. 1. Sergt. J. M. Phale, Fort Snelling, Minn., sends us a sketch of a train of gears, which sketch is reproduced herewith, and asks: How much weight applied at F is required to lift 10 pounds at E?

A. 1. Ernest K. Chapin answers as follows: Suppose wheel A rotates once. It is evident that B will rotate 6 times and C 36 times. Then the 10-pound weight will be raised a distance $36 \prod D$



An interesting problem in physics has been proposed by Sergt. Phale. The details of the proposition are given above.

or $36 \times 3.1416 \times 8$ or 904.78 inches. The applied force F will act through a distance $\prod D$ or $3.1416 \times 23"$ or 72.26 inches. The ratio $\frac{904.78}{72.26}$ is called the mechanical advantage of the machine. It is the ratio of F to 10, or F. Hence

$$\frac{F}{10} = \frac{904.78}{72.26} \text{ or } F = \frac{904.78 \times 10}{72.26} = 125.1 \text{ pounds}$$

(nearly), neglecting friction.

VOLTMETER

(1924) Q. 1. Chas. Pfeiffer, Philadelphia, Pa., asks several queries regarding voltmeter connections, including among them a suggestion for shunting the meter with a heavy wire so that more current can be drawn through the entire circuit.

A. 1. A voltmeter is never used in series with a line, for the reason that it is a high resistance instrument and not much current can be drawn through it. As for short circuiting it with a heavy wire, results will not be obtained. The only place a voltmeter can be used is across the line or across an instrument to measure the voltage drop across it. A voltmeter will not burn out when put across 110 volts even though the wire used on it is No. 28, providing that the scale reading is 110 or over.

A PROBLEM

(1925) Q. 1. Ralph M. Persell, Gulfport, Miss., propounds the following problem. A rabbit and a turtle are moving in the same direction, the turtle in the lead and a certain distance ahead of the rabbit. The turtle moves at a constant rate. The rabbit moves in steady jumps, each jump decreasing the distance by one-fifth. Will the rabbit, since he moves at a rate that is steadily decreasing, overtake the turtle?

A. 1. In your problem which probably originated along with Aesop's Fables, the rabbit can never catch the turtle. The probem states specifically that with each jump the distance X between the rabbit and the turtle is lessened by one-fifth. Thus there always remains the constantly changing distance X and 4/5 X, alternately between both the animals. Therefore, it is clearly evident that the rabbit cannot catch or pass the turtle.

AUTO COOLING SYSTEM

(1926) Q. 1. J. Simmons, Chicago, Ill., says that he has been told that it is not good practice to mount a license plate of an automobile directly on the front of the radiator. He asks our opinion.

A. 1. Whoever informed you in this matter was perfectly correct. Any obstructions to the flow of air through the radiator of an automobile should be removed. License plates, club insignias and other obstructions of a similar nature tend to reduce the efficiency of the cooling system of the automobile, and if they are large enough will cause the water in the radiator to boil when even a slight load is placed upon the motor such as climbing small grades. It is best to provide otherwise for the disposition of license plates, etc., than on the radiator itself.

ANCESTRY

(1927) Q. 1. H. B. Bull, Dalzell, S. C., says that, in a certain periodical, he read of a theory which states that the greater number of generations that you go back through history, the greater number of ancestors in each generation a certain person has. If you go back far enough, would not the number of ancestors, according to this theory, be as great as the population of the world at that time? How can this be true?

A. 1. Theoretically, what you say is true up to a certain point. This is, of course, granting that the Biblical story of the beginning of man is true. The number of ancestors will increase as you go back, but you must remember that these ancestors are also related to other people living in the present generation. As you trace your ancestry back, the number of relatives in each generation will become larger up to a certain period of the human race's history, whereupon it will start to narrow down again until, still accepting the Biblical theory, the ancestors of the entire human race narrow down to just two—Adam and Eve. Of course, however, we must remember that this theory of the beginning of man is a mooted question.

CHLORINE

(1928) Q. 1. E. Merrick, Kansas City, Mo., asks how chlorine gas can be prepared in the laboratory.

A. 1. If one part by weight of salt, to one part of manganese dioxide be mixed with two parts of sulphuric acid and two of water, and are put in a large flask and heated slightly, chlorine gas will be given off.

Q. 2. Can you give several methods for the production of heavy clouds of smoke?

A. 2. Allow the fumes of hydrochloric acid and ammonium hydroxide to mingle.

REMOVING OXIDE

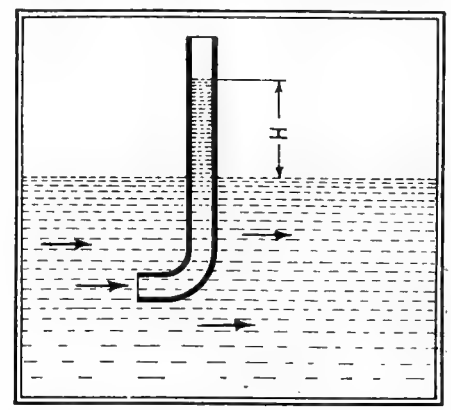
(1929) Q. 1. G. F. Minor, Richmond, Va., asks us to tell him the best method for quickly removing oxide from small rough aluminum castings without recourse to chemicals.

A. 1. To remove the oxide formed on rough aluminum castings, we would suggest that you tumble them in sawdust and water until they are free from the material. This could be done by constructing a container and filling it with the mixture of sawdust and water. Introduce the castings and revolve the entire container until the desired results are obtained.

PITOT TUBE

(1930) Q. 1. Maurice Rawley, Winnipeg, Man., Canada, asks: What is a Pitot tube, and how is it used for the measurement of the flow of water?

A. 1. Our illustration shows a Pitot tube which consists of nothing more nor less than a tube bent at right angles at one end. It is placed in a flowing stream of water for measuring either



The shape and action of a Pitot tube for measuring the rate of flow of a stream of water can be seen above.

the velocity of the current or the head of water from which the stream is flowing. In the latter case the distance H is equal to the velocity head. The linear velocity of the stream is $V = \sqrt{2GH}$. In this formula, H is the distance shown in the illustration in feet, G is a constant, 32.16 and V equals the velocity in feet per second. This formula applies only to water flowing freely and cannot be used for determining the rate of flow in a pipe.

ANT EXTERMINATORS

(1931) Q. 1. B. Alonso, Cienfuegos, Cuba, asks for good ways in which ants can be exterminated.

A. 1. A weak solution of corrosive sublimate is very deadly to ants. Carbon disulphide is also to be recommended, particularly for destroying ants' nests. Pour a little of the chemical over the hill and then cover with a little dirt. The vapors of the chemical will penetrate the extremities of the burrows and will kill not only the adult insects, but the young and the larvæ as well. If not successful the first time, try again, using more of the carbon disulphide.

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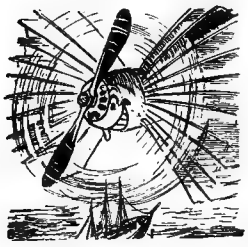
Non-Sc(i)ence

THE FLAPPER PLANE



In the Boston *Advertiser* of June 18th we find that during the send off of the MacMillan exploring party to the north in their ship "Peary" there was a "shrieking farewell" in which "whistles blew, spectators shouted and airplanes beat their wings overhead."

I maintain that this is a false statement. No self-respecting, properly conducted airplane would "beat its wings." No sir. Not even at so memorable an occasion as this one.—*Sinclair Bowman.*

WEEDS GROW FAST

"Fastest growing two for fifteen cent cigars" reads an advertisement in the *News Times* of South Bend, Indiana.

Are we to understand that they give us the cabbage in the green state and then grow the cigar to the required length? Hemp grows—do ropes? There should be a limit to their size as a six-foot stogie would be rather difficult to handle in the crowded elevators of business buildings. Perhaps some inventor will discover a means for transporting these monsters.—*Stanley Rider, Jr.*

JUST MELTED AWAY

A clipping from the New York *American* of June 16, 1925, advises that, "Peter Day, 70 **. . . dripped dead** while waiting for a train in the railroad station at Frank Avenue, Rockaway Beach."

What a death this is. Like a piece of butter the heat caused the poor unfortunate man to melt away.—*H. M. Kennedy.*

A REMARKABLE VIBRATOR

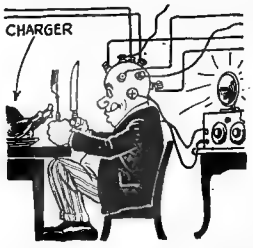
In an article in *Popular Science Monthly* entitled "Clock shuts off the gas when the meal is cooked," we find the following: "the clock is set for the number of minutes it should take the food to cook and when those minutes have elapsed the alarm goes off. **The vibration of the bell turns the gas off automatically.** They are evidently equipping gas stoves with silent watchmen who are brought up to dread the sound produced by the vibration and when they hear the sound produced by the bell they respect the signal and promptly shut off the source of gas supply.—*J. H. K.*

Money for Science Mistakes

The newspapers throughout the country, as well as the magazines, occasionally err. Sometimes these errors are misprints. At other times they are pure scientific misstatements. If you happen to see any of these humorous mistakes in the press, we will be glad to have you clip them out and send them to us. Give the name of the newspaper or magazine in which the error appeared and accompany the inclosure with a few humorous lines. The most humorous ones will be printed in this department, and for each one accepted and printed we will pay $1.00. No NON-SC(i)ENCE entry will be accepted, unless the printed original accompanies the same. Address all NON-SC(i)ENCE entries to:

Editor, NON-SC(i)ENCE Dept., c/o Science & Invention Magazine, 53 Park Place, New York City.

THE COMPLETE ELECTRICIAN



The Montreal (Canada) *Daily Star* in their issue of June 22nd, published the following advertisement **"Wanted—Battery man with connection."** Wonder what Fahnstock will do when all battery men will have their own connections. I suppose a hearty meal will serve as a charger and the employee will eventually be the discharger.—(Unless the author sends us his name we will be unable to make connection with the check.)

WHEN HELL FREEZES OVER

One enterprising advertising manager outdid himself when he placed an advertisement in all the San Francisco papers for the Paramount picture "Grass" which reads as follows: "Grass, unfed, unshod, clothed only in courage 50,000 human beings, 500,000 beasts enact a drama greater than the mind of man could imagine, greater than the hand of man has written.

On the frozen highways of the forgotten world where **cold snow burned like the fires of hell and blasts of the sun froze the blood in their veins . . .** a lost people are fighting an inclement nature for one blade of grass."

What an opportunity for the Round the World Advertisers; think of a place where the snow burns like hell and the sun comes in blasts that will freeze your blood! Some spot! No wonder the grass won't grow!

I will appreciate one buck for the above and will use this to travel to the spot above described.—*Raymond Travers.*

JAMES PUT THE STARS AWAY

Now see what the milkmen have done by cluttering up the heavens and leaving a trail of broken bottles which many of us call the milky way. Here is an advertisement from the New York *Sun* for June 23rd, "Wanted—**man to clean nights. . . . must have A-1 references.**"

We presume that transportation will be via radio waves and if the Heaviside layer does not reflect the wave train the job should not be difficult.—*Mrs. N. Schwartz.*

DUNNIGER OUTDONE

In the June 24th issue of the Highpoint, North Carolina, *Enterprise* appears the following. "One day while ironing the **iron cord was a two-way socket the light** in the other."

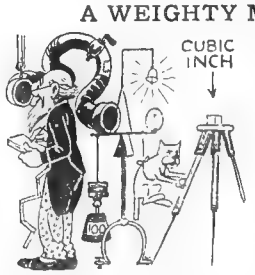
This appears to be a fairy tale instead of a news item. Evidently a double socket was in greater demand at the moment than the iron cord. "Lo! iron cord! became a two-way socket" and "the light was in the other" and so they made a two-way socket out of the single iron cord. What will science do next?—*Chas. W. Cannon.*

FOR SALE—ONE INCH

The June 22nd issue of the *Schenectady Gazette* contained the following advertisement: **"Kilometer for Sale** in perfect condition used only a short time."

It looks as if someone is trying to sell real estate in the first dimension: second handed at that. The State Highway Commission would like to know on what grounds this kilometer is offered for sale. Now we hope some of our bright readers will not write in and say wet grounds or coffee grounds or words to that effect.—*W. Laine.*

A WEIGHTY MATTER



On page 450 of price list 25 of the E. H. Sargent & Co. (Chicago) we find the following "Volunteer — Scotts, designed by the late W. G. Scott, especially for the use of paint chemists **for measuring the volume of one cubic inch** of powdered material."

We wonder when machines will be invented which will determine the weight of one ounce or the length of one yard or perhaps the temperature at zero degrees centigrade. "Well well exactly three o'clock, I wonder what time it is."—*Alton C. Kurtz.*

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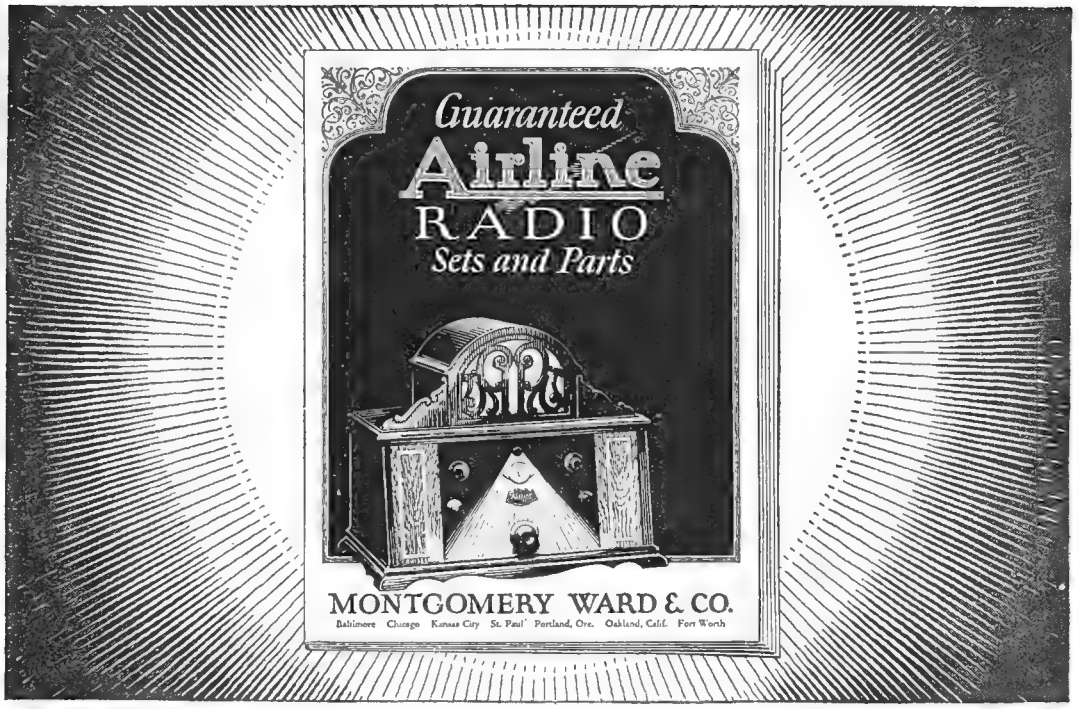

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Tarrano the Conqueror

By RAY CUMMINGS

(*Continued from page* 525)

ference in Great-London. Three rulers protem—White, Yellow and Black—to replace the three who had been assassinated. The responsibility for the assassinations was placed by the Council upon Tarrano. But this—from his Headquarters here in Venia—he blandly refused to accept, denying all knowledge of the murders. Venia was the principal Venus Immigrant colony of Earth's Western Hemisphere. It had already been closed by our Earth-Council; its inhabitants interned as possible alien enemies, pending diplomatic developments. This was the meaning of that line of official vessels lying there to the north on guard. No one could leave Venia, and for a day Venus refugees had been ordered into it from everywhere.

At 8:40 this evening came from Great-London our ultimatum to Tarrano. A duplicate of it went to the Great City of Venus via the Hawaiian Station. The Earth would not recognize the Tarrano government of Venus. We would hold to our treaty of friendship with the Central State. We would remain neutral for a time. But Tarrano himself we declared an outlaw. His presence was required in Washington to stand trial for the assassinations, and the delivery in Washington of Dr. Brende's notes and model was demanded.

The ultimatum carried a day of grace; the alternate was a declaration of war by the Earth, and our immediate attack upon Venia. It was the same proposition which our War Director had previously made unofficially to Tarrano while he was there in the garden with Elza and which Tarrano so summarily had rejected.

The ultimatum came to us in the tower as we sat listening to the announcer's measured tones. Elza exclaimed:

"But why do they wait? Father's model must be here. Tarrano, the leader of all this—is here. Within the hour those vessels of war could sweep in here—capture Tarrano—recover father's model——"

Georg interrupted quietly: "No one knows if the model is here. That other car from the laboratory—we don't know where it went. The plundered laboratory has been found, of course. No station up there is near enough to have eavesdropped upon our capture, but the whole thing must have come out by now. But that aero with the model may have met an Inter-planetary vessel—the model may be on the way to Venus by now."

"Georg," I exclaimed, "do *you* know the workings of that model? Could you build another without the notes?"

He nodded solemnly. "Yes. And they know that, in Washington. I could build another. But they know by now, that I, too, am in Tarrano's hands——"

"And he will kill you, of course, to destroy that knowledge and keep the secret for himself——" I did not say it aloud, for Elza's sake; but I thought it, and I realized that Georg was thinking it also.

Dr. Brende's secret of longevity was the crux of all this turmoil——the lever by which Tarrano was raising himself. Scores of facts amid the tumultuous news of these hours showed us that. For months, throughout Venus, Tarrano had spread the insidious propaganda that he alone had the secret of immortality—that when he was made ruler, he would use it for the benefit of his followers.

Converts to Tarrano's cause were everywhere. In the Central State many welcomed the coming of his army. And now from the Great City his propaganda was being sent to the Earth. Murmurs from our own Earth-public were beginning to be heard. The ignorant lower classes seemed ready to swallow anything. A new beneficent ruler who guaranteed everlasting life! Throughout the ages people have flocked to that same standard!

In Mars, much the same was transpiring. At almost her closest point to the Earth these days, Red Mars sent us constant helios from the midnight sky. The Little People had appointed a new ruler to take the place of him who had been assassinated. The Council there put the assassination to unknown causes. Tarrano was held blameless. The Little People declared themselves neutral. But they gave prompt official recognition to the Tarrano Government of Venus. And everywhere throughout Mars the public was stirred by the thought of everlasting life.

"Fools!" muttered Georg. "That Little People government—they'll have a revolution of their own to fight at this rate. Can't you see what Tarrano is doing? Working everywhere with propaganda—working on the public—the gullible public ready always to swallow anything——"

On Earth, lay the crisis. Our own governments only had taken a firm stand. What could Tarrano do with this ultimatum? Either he must yield himself and the Brende secret, or a war in which he would be immediately overwhelmed here in Venia would follow.

It was nearly ten o'clock that first night. Elza had gone to the balcony. We heard her call us softly, but with obvious tenseness. Out there we found her pointing excitedly. A few hundred feet away and somewhat below us was a tower similar to our own. In one of its oblong casements a glow of rose-light showed. And within the glow was the full-length figure of a girl. We could see her plainly, though a small image at that distance with the naked eye, and our personal vision instruments had been taken from us. A slender, imperial figure—a young girl seemingly about Elza's age. Dressed in a shimmering blue kirtle, short after the Venus fashion, with long grey stockings beneath. A girl with flowing waves of pure white hair to her waist—a girl of the Venus Central State. She seemed, like ourselves, a prisoner. An aura or barrage was around her tower. She stood there, back in the tower room, full in the rose-light as though surreptitiously trying to attract our attention.

As we gathered on our balcony, behind the glow of our own barrage, she gestured to us vehemently. And then, with one white arm, she began to semaphore. One arm, and then with both. Georg and I recognized it—the Secondary Code of the Anglo-Saxon Army. We murmured the letters aloud as she gave them:

"*I am——*" Abruptly she stopped. A violent gesture, and she disappeared; her rose-glow went out; her tower casement was dark. On a lower spider bridge Tarrano had appeared. He was crossing it on foot toward our tower, his small erect form advancing hastelessly, with the figure of Argo behind him.

(*Continued on page* 560)

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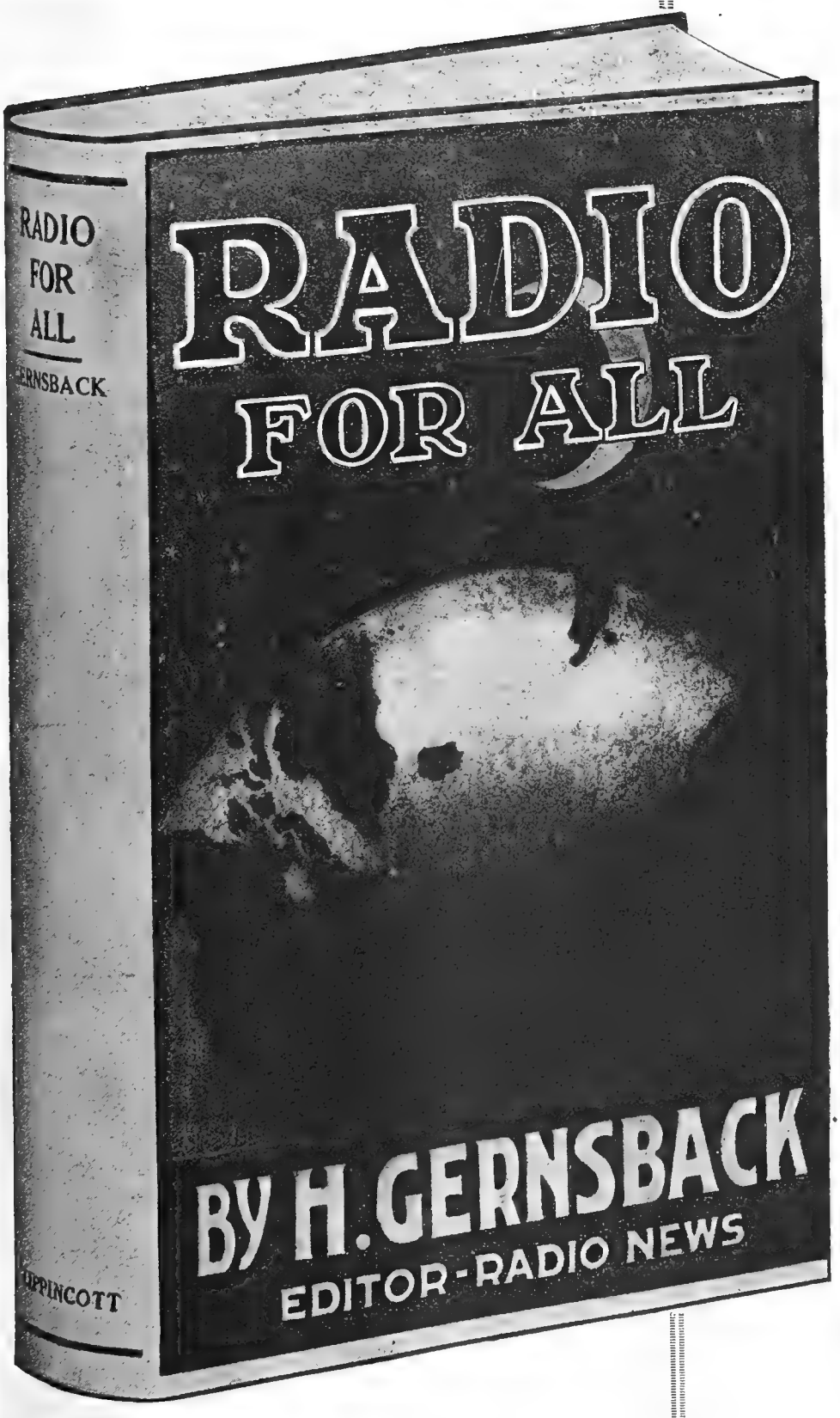

RADIO'S

Most Complete Book of Information

By H. GERNSBACK

Editor of RADIO NEWS, SCIENCE AND INVENTION, THE EXPERIMENTER, and MOTOR CAMPER & TOURIST

What the novice in radio needs is a book in which he can get all the information necessary for him to understand radio telephony and telegraphy, to make or buy a receiving set suitable to his means, to know how to operate his set, and, after he has an understanding of the radio art, information that will enable him to advance and get the most out of his outfit. All this must ordinarily be dug out of textbooks, pamphlets and government publications, but the aim of this book is to have all the data and information that the beginner will need from the time that he takes up radio. It is a permanent, comprehensive reference book for the dyed-in-the-wool dabbler in Radio.

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Tarrano the Conqueror

(*Continued from page* 558)

He reached our lower entrance, cut off the barrage there, and entered. Argo replaced the barrage, lingered an instant, gazing upward at us with his habitual leer. Then he retraced his steps across the bridge and disappeared.

A moment more, and in our lounging apartment Tarrano faced us.

CHAPTER VIII

THE UNKNOWN FRIEND

"Sit down." Tarrano motioned us to feather hassocks and stretched himself indolently upon our pillowed divan. With an elbow and hand supporting his head he regarded us with his sombre black eyes, his face impassive, an inscrutable smile playing about his thin lips.

"I wish to speak with you three. The Lady Elza——" His glance went to her briefly, then to Georg. "She has told you, perhaps, what I had to say to her?"

"Yes," said Georg shortly.

Elza had indeed told us. And with sinking heart I had listened, for it did not seem to me that any maiden could resist so dominant a man as this. But I had made no comment, nor had Georg. Elza had seemed unwilling to discuss it, had flushed when her brother's eyes had keenly searched her face.

And she flushed now, but Tarrano dismissed the subject with a gesture. "That—is between her and me. . . . You have been following the general news, I assume? I provided you with it." He rolled a little cylinder of the arrant leaf, and lighted it.

"Yes," said Georg.

Georg was waiting for our captor to lay his cards before us. Tarrano knew it; his smile broadened. "I shall not mince words, Georg Brende. Between men, that is not necessary. And we are isolated here—no one beyond Venia can listen. As you know, I am already Master of Venus. In Mars—that will shortly come. They will hand themselves over to me—or I shall conquer them." He shrugged. "It is quite immaterial." He added contemptuously: "People are fools—almost everyone—it is no great feat to dominate them."

"You'll find our Earth leaders are not fools," Georg said quietly.

Tarrano's heavy brows went up. "So?" He chuckled. "That remains to be seen. Well, you heard the ultimatum they sent me? What do you think of it?"

"I think you'd best obey it," I burst out impulsively.

"I was not speaking to you." He did not change the level intonation of his voice, nor even look my way. "You are to die tomorrow, Jac Hallen——"

Elza gave a low cry; instantly his gaze swung to her. "So? That strikes at *you*, Lady Elza?"

She flushed even deeper than before, and the flush, with her instinctive look to me that accompanied it, made my heart leap. Tarrano's face had darkened. "You would not have me put him to death, Lady Elza?"

She was struggling to guard from him her emotions; struggling to match her woman's wit against him.

"I—why no," she stammered.

"No? Because he is—your friend?"

"Yes. I—I would not let you do that."

"Not let me?" Incredulous amusement swept over his face.

"No. I would not—let you do that." Her gaze now held level with his. A strength came to her voice. Georg and I watched her—and watched Tarrano—fascinated. She repeated once more: "No. I would not let you."

"How could you stop me?"

"I would—tell you not to do it."

"So?" Admiration leaped into his eyes to mingle with the amusement there. "You would tell me not to do it?"

"Yes." She did not flinch before him.

"And you think then—I would spare him?"

"Yes. I know you would."

"And why?"

"Because—if you did a thing like that—I should—hate you."

"Hate——"

"Yes. Hate you—always."

He turned suddenly away from her, sitting up with a snap of alertness. "Enough of this." Did he realize he was defeated in this passage with a girl? Was he trying to cover from us the knowledge of his defeat? And then again the bigness of him made itself manifest. He acknowledged soberly:

"You have bested me, Lady Elza. And you've made me realize that I—Tarrano—have almost lowered myself to admit this Jac Hallen my rival." He laughed harshly. "Not so! A rival? Pah! He shall live if you wish it—live close by you and me—as an insect might live on a twig by the rim of the eagle's nest . . . Enough! . . . I was asking you, Georg Brende, of this ultimatum. Should I yield to it?" He had suppressed his other emotions; he was amusing himself with us again.

"Yes," said Georg.

"But I have already refused—today in the garden. Would you have me change? I am not one lightly to change a decision already reached."

"You'll have to."

"Perhaps. Perhaps not. Of one thing I am sure. I cannot let them declare war against me just now. I have no defense, here in Venia. Scarce the armament for my handful of men. Your vessels of war would sweep down here and overpower me in a breath—trap me here helpless——"

"Of course," said Georg.

"And so I must not let them do that. They want me to come to Washington with the Brende model—deliver it over to them. Yet—that does not appeal to me. Tomorrow I shall have to bargain with them further. I could not deliver to them the Brende model." He was chuckling at his own phrasing. "No——no, I could not do that."

"Why?" demanded Georg. "Isn't the model here?"

"It is—where it is," said Tarrano. He became more serious. "You, Georg—you could build one of those models?"

Georg did not answer.

"You could, of course," Tarrano insisted. "My spy, Ahla—you remember her, the Lady Elza's maid for so long? She is here in Venia; she tells me of your knowledge and skill with your father's apparatus. So you see, I realize I have two to guard—the model itself, and you, who know its secret."

He now became more openly alert and earnest than I had ever seen him. The light from the tube along the side wall edged his lean, serious face with its silver glow. "I've a proposition for you, Georg Brende. Between men, such things can be put bruskly. Your sister—her personal decision will take time. I would not force it. But meanwhile—I do not like to hold you and her as captives."

The shadow of a smile crossed Georg's face. "We shall be glad to have you set us free."

(*Continued on page* 562)

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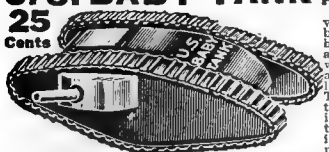

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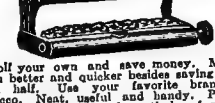

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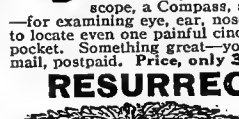

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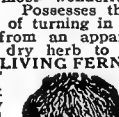

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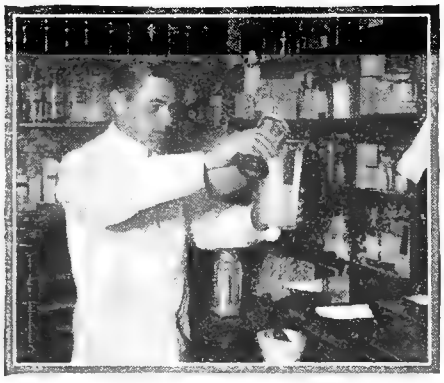

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Tarrano the Conqueror

(*Continued from page* 560)

Tarrano remained grave. "You are a humorist. And a clever young fellow, Georg Brende. You—as Elza's brother—and as your father's son with your medical knowledge—you can be of great use to me. Suppose I offer you a place by my side always? To share with me—and with the Lady Elza—these conquests. . . . Wait! It is not the part of wisdom to decide until you have all the facts. I shall confide in you one of my plans. The publics of Venus, Mars and the Earth—they think this everlasting life, as they call it, is to be shared with them."

His chuckle was the rasp of a file on a block of adamant. "Shared with them! That is the bait I dangle before their noses. In reality, I shall share it only with the Lady Elza. And with you—her brother, and the mate you some day will take for yourself. Indeed, I have a maiden already at hand, picked out for you. . . . But that can come later. . . . Everlasting life? Nonsense! Your father's discovery cannot confer that. But we shall live two centuries or more. Four of us. To see the generations come and go—frail mortals, while we live on to conquer and to rule the worlds. . . . Come, what do you say?"

"I say no."

Tarrano showed no emotion, save perhaps a flicker of admiration. "You are decisive. You have many good qualities, Georg Brende. I wonder if you have any good reasons?"

"Because you are an enemy of my world," Georg declared, with more heat than he had yet displayed.

"Ah! Patriotism! A good lure for the ignorant masses, that thing they call patriotism. For rulers, a good mask with which to hide their unscrupulous schemes. That's all it is, Georg Brende. Cannot you give me a better reason? You think perhaps I am not sincere? You think I would not share longevity with you—that I would play you false?"

"No," Georg declared. "But my father's work was for the people. I'm not talking patriotism—only humanitarianism. The strife, suffering in our worlds—you would avoid it yourself—and gloat while others bore it. You——"

"Youth!" Tarrano interrupted. "Altruism! It is very pretty in theory—but quite nonsensical. Man lifts himself—the individual must look out for himself—not for others. Each man to his destiny—and the weak go down and the strong go up. It is the way of all life—animal and human. It always has been—and it always will be. The way of the Universe. You are very young, Georg Brende."

"Perhaps," Georg said, and fell silent.

Tarrano abruptly rose to his feet. "Calm thought is better than argument. You have imagination—you can picture what I offer. Think it over. And if youth is your trouble ——" His eyes were twinkling. "I shall have to wait until you grow up. We have a long road to travel—Empires cannot be built in a day."

He paused before Elza with a grave, dignified bow. "Goodnight, Lady Elza."

"Goodnight," she said.

He left us. We stood listening to his footsteps as he quietly descended the tower incline. At his summons, the barrage was lifted. He went out. From the balcony we saw him cross the spider bridge, with Argo at his heels. As they vanished into the yawning mouth of an arcade beyond the bridge, again came that rose-glow in the other tower. We saw again the girl with flowing white hair standing there. And now she was waving us back.

"She wants us inside, where we can't be seen," Georg murmured. We drew back into the room, standing where we still could see the girl. I wondered then—and we had discussed it several times these last hours—if the interior of our tower were under observation by some distant guard. We felt that probably it was, visibly and audibly; and we had been very careful of what we said aloud.

But now, if we were watched, we could not help it; we would have to take the chance. The figure of the girl showed plainly down there through the other casement. And again, with slow-moving white arms she began to semaphore. A queer application of the Secondary Code, which always is used officially with coral-light beams over considerable distances. But it sufficed in this emergency. Slowly she spelled out the letters, words, phrases.

"I am Princess Maida——"

Georg whispered to us: "Hereditary ruler of the Central State——"

I nodded. "Watch, Georg——"

"Prisoner——" came next: *"Like yourselves, and we must escape."*

She paused a moment, letting her arms drop to her sides, shaking the glorious waves of her white hair with a toss of her head. Then, at a gesture from Georg that he understood, she began again:

"Escape tonight——"

I half expected that any moment Tarrano or one of his men would burst in to stop this. But the signals continued.

"I am sending you a friend—tonight—soon—he will come to you. With plans for our escape. A good friend——"

Her tower abruptly went dark. Cautiously I gazed down from our balcony. Argo had appeared on the spider bridge; he was pacing back and forth. Did he suspect anything? We could not tell, but it seemed not. It was the midnight hour; a brilliant white flash swept the city to mark it.

In a low corner of the balcony, behind the glow of our barrage, we crouched together, whispering excitedly. But cautiously, for we knew that the microphonic ears of a jailor might be upon us. The Princess Maida—here in Tarrano's hands! She was sending us a friend—tonight—soon; a friend who would help us all to escape.

"By the code!" Georg exclaimed. "If we could get to Washington—if I could be there now in this crisis—with my knowledge of the Brende light——"

Far above our personal safety, our lives, lay the importance of Georg's knowledge. With the Brende secret—through him—in the hands of the Earth Council, Tarrano's greatest lever to power would be broken. Our Earth-public would sway back to patriotic loyalty. The Little People of Mars unquestionably would remain friendly with us, with the Brende light to be developed on Earth and shared with them. They would see Tarrano perhaps, for what he was—a dangerous, unscrupulous enemy. . . . If only Georg could escape. . . .

An hour went by with murmured thoughts like these. A friend coming to help us? How could he reach us? And how help us to escape?

We crouched there, waiting. Argo—obviously on night guard—still paced the bridge. The city was comparatively dark

(*Continued on page* 564)

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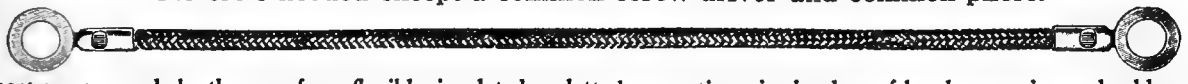

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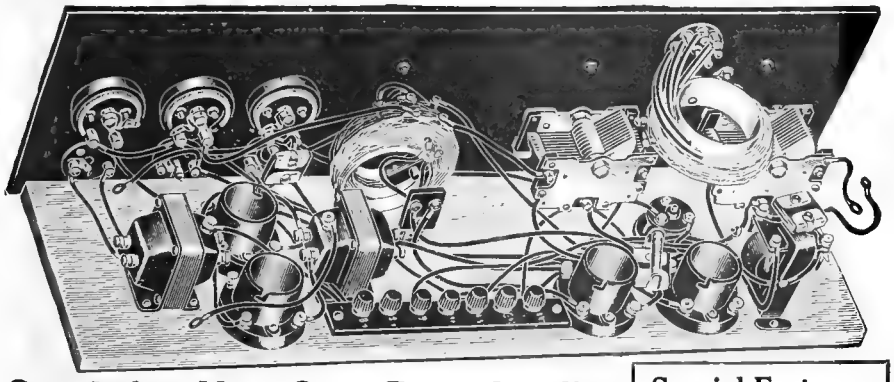

See what Doubleday, Page & Co., through Mr. Arthur H. Lynch, Editor of their magazine, "Radio Broadcast," say about the Radio Broadcast's sensational 4-Tube Knock-Out Set developed by Walter Van B. Roberts:

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"I have followed the development of the Roberts circuit with results far beyond all expectations. I find it to be EXACTLY as efficient as described, although I was skeptical as to the unusual operation that it was said to have accomplished. I no longer have any doubts, for in the last week of August and to date in September, I have received KGO at least four times. On one of these occasions I received it on my Dictograd loud speaker, **using only two tubes!** I have consistently received long distance, such as Dallas, Fort Worth, Auburn, La., Hastings, and Kansas City, in all about 65 stations, while just "fishing." Locals, such as Pittsburgh, Schenectady, New York City, Chicago, Boston, etc., it need not be mentioned, are perfect, **even on occasions when I have used neither aerial nor ground.** I am sure it was a lucky day when this set came to my attention." L. L. Clifford, 190 Second Street, Fulton, NEW YORK.

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WJZ	72	65	N. Y. City
WEAF	86	77	N. Y. City
WFBH	65	21	N. Y. City
WFAM	55	18	St. Cloud, Minn.
WQAO	73	40	N. Y. City
WEBH	75	13	Chicago
WJY	72	52	N. Y. City
KDKA	70	32	E. Pittsburgh, Pa.
WTAS	67	25	Elgin, Ill.
WGBS	67	30	N. Y. City
WHN	72	39	N. Y. City
WJAX	88	48	Cleveland
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KYW	78	93	Chicago
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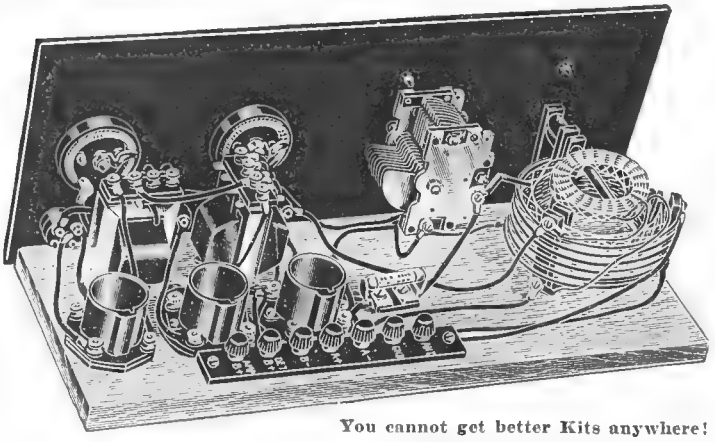

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Tarrano the Conqueror

(*Continued from page* 562)

and silent; yet even so, there seemed more activity than we felt was normal. Occasional beams flashed across the narrow segment of our sky. The crescent terraces, visible through a shallow canyon of buildings to the left, were a blaze of colored lights with the dark figures of people thronging them. The mingled hum of instruments was in the night air; sometimes the snap of an aerial; and the steady, clicking whir of the night escalators on the city street levels and inclines.

It seemed hours that we waited. The green flash of the second hour past midnight bathed the city in its split-second lurid glare. Elza had fallen asleep, beside us on the feathered hassock of our balcony corner. But Georg and I were fully alert—waiting for this unknown friend. Georg had smoked innumerable arant-leaf cylinders. Through the insulated tube, from a public cookery occasional hot dishes were passing our dining room for us to take if we wished. But we had touched none of them. From the food stock on hand, Elza had cooked our two simple meals. But now, with Elza asleep, Georg left me and returned in a moment with steaming cups of taro. We drank it silently, still waiting. Argo still paced the bridge on guard. Presently we saw the figure of Wolfgar join him. The two spoke together a moment; then Argo disappeared; Wolfgar paced back and forth on guard in his place.

At 2:30 the Inter-Allied Announcer—for half an hour past quite silent—brought us to our feet, his monotone droning from the disc in our instrument room:

"Great-New York, Inter-Allied Unofficial 2:27 A. M. Tarrano replies to the Earth-Council Ultimatum. . . ."

Our start woke up Elza. Together we rushed into the instrument room.

"With many hours yet before the Earth-Council Ultimatum expires, it is unofficially reported that Tarrano has sent his note in answer. Its text, we are reliably informed, is now in the hands of our Governments at Great-London, Great-New York, Tokyohama and Mombozo. Helios of it also have been sent to Tarrano's own government of Venus and to the Little People of Mars. We have as yet no further details. . . ."

A buzz came as he ended, with only the click of the tape continuing as it printed his words. A moment of silence, then again his voice:

"Official 2:32 A. M. Inter-Allied News: Tarrano rejects Ultimatum. His note to Earth-Council complete defiance. Official text follows. . . ."

We listened, dumb with amazement and awe. Tarrano's note was indeed, complete defiance. He would not yield up the Brende light. Nor would he deliver himself in Washington for trial. In the suave, courteous language of diplomacy, he deplored the unreasonable attitude of the Earth leaders. Ironically, he suggested that they declare war. He would be overwhelmed in Venia, of course. He had no means of defending himself against their aggression. But at the first flash of hostile rays, the Brende model would be destroyed forever. And Georg Brende—the only living person who had the knowledge to replace the model—would die instantly. The Brende secret would be lost irrevocably. It was unfortunate that suffering humanity on Earth, Venus and Mars, should be denied their chance for immortality. Unfortunate that the Earth leaders were so headstrong. They were enemies, in reality, of their own people—and enemies of the peoples of Venus and Mars. But if the Earth Council wished war with Tarrano—then war let it be.

"A bluff," I exclaimed. "He would lose everything himself. It's suicide—"

"Not suicide," Georg said soberly. "Propaganda. Can't you see it? He knows the Earth Council will make no move until the ultimatum time has expired. Hours yet. And in those hours, he is working upon the publics of the three worlds."

The announcer was silent again. Below us, in our tower, we heard a footstep. The barrage had been lifted to admit someone, then thrown on again. Measured footsteps were coming up our incline. We stood motionless, breathless. A moment; then into the room came Wolfgar. He did not speak. Advancing close to us as we stood transfixed, he jerked an instrument from his belt. It whirred and hummed in his hand. The room around us went black—a barrage of blackness and silence, with ourselves and Wolfgar in a pale glow standing within it as in a cylinder. The isolation-barrage. I had never been within one before, though upon drastic occasion they were in official use.

Wolfgar said swiftly: "We cannot be seen or heard. I have been in charge of the mirror observing you—I have thrown it out of use. The Princess Maida—"

"You are—the friend?" Georg whispered tensely. Elza was trembling and I put my arm about her.

Wolfgar's face lightened with a brief smile; then went intensely serious. "Yes. A spy, trusted by Tarrano for years—but my heart is with the Princess Maida. We must escape—all of us—now, or it will be too late."

He stopped abruptly, and a look of consternation came to him. The black silence enveloping us had without warning begun to crackle. The metal cone in Wolfgar's hand glowed red with interference-heat—but he clung to it, though it burned him. Sparks were snapping in the blackness around us. Our isolation was dissolving. Someone—something—was breaking it down, struggling to get at us!

—END OF PART IV—

(*To be continued*)

Superpower—Is It Here To Stay?

By JACK MILLIGRAM

(*Continued from page* 540)

type enormous, but its upkeep runs into figures that far exceed the average man's income. Who will pay this bill? Obviously, someone has to and that is a question which must be seriously considered. Of course, those who are now conducting superpower broadcasting stations are doing so as much for their own benefit as for yours. They are deriving an enormous amount of information from the experimental work conducted along these lines and are being amply repaid for their trouble in this way. However, this cannot keep up forever. Very

(*Continued on page* 566)

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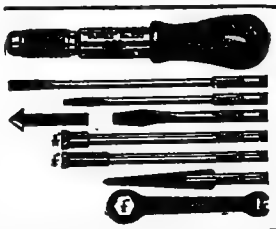

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PRICE per set—No. 701.....$3.00

HAND DRILL

The hardwood handle is hollow to store drills. Iron frame, nickeled parts, ball bearing three jawed chuck holding and centering accurately round shank drills from 0 to 3-16. Length of drill, 12 inches.
PRICE—No. 303 .....$2.25

WIRE BENDING TOOL

For making eyes, loops, bends, and offsets on Bus Bar wire. With this device any Radio Constructor can wire his set to compare favorably with any factory made set. Easier to use and more accurate than pliers. Full directions in box. Made of heavy steel, blued and finished.
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401. Same tool but smaller and not fitted with bead or scroll in one operation.
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Especially designed for Radio Work by the makers of the famous "Yankee" Tools. A beautiful balanced, small, powerful drill with 4 to 1 ratio of gears for speed. Special chuck 9-32" capacity, to take largest drill, mostly furnished with drill or tool sets. Length over all, 9½ in. Weight 1¼ lbs.
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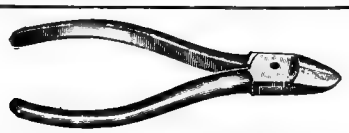

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Holds any screw by its slot with a firm grip, makes it easy to place and start screws in difficult places. Just the tool for the Radio Constructor. All parts heavily nickeled and polished.
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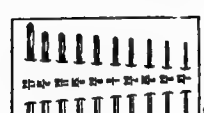

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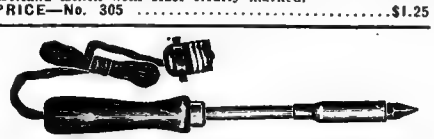
PRICE—No. 305 .....$1.25



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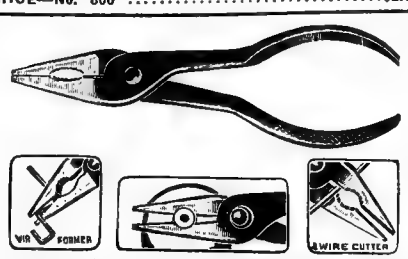

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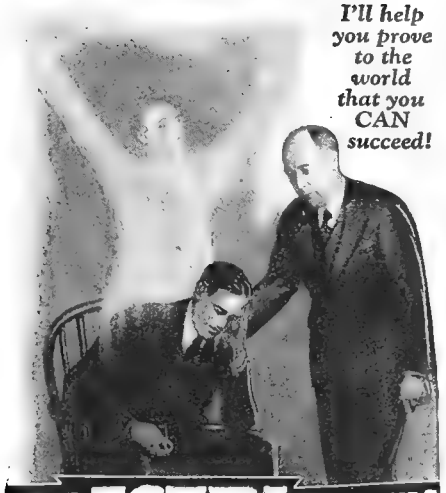

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Superpower—Is It Here to Stay?

(*Continued from page* 564)

shortly these stations will have to put on regular programs just the same as the lower powered stations do today. Of course, the advertising value from such a proposition is going to be great and undoubtedly will aid in the upkeep. If, however, some system were brought into play in this country such as is used in England, we would undoubtedly immediately gain great benefits from it in the direction of excellent programs. In England the British Broadcasting Co., holds a monopoly on broadcasting and the government licenses all receiving sets. A good portion of the money obtained in this way is reinvested in the broadcasting stations to pay for the upkeep of the apparatus and for the entertainers. It is obvious that paid entertainers are far superior to those giving their services gratis and sometimes in a rather erratic manner. If this country had more paid artists and fewer amateur entertainers, broadcasting would have a much better reputation than it has today. Possibly something of the same nature as the system used in England will be incorporated in this country.

Then, on the other hand, things may work out to a point where the large manufacturers of radio receiving apparatus who maintain broadcast stations will become so stabilized in their business that they will sell the greater majority of the broadcast listening apparatus. Consequently, the profits that will ensue in this way can be turned into broadcasting and used for the upkeep of superpower stations.

SUPER-BROADCASTING

Another term that has recently been brought into use along with superpower is that of super-broadcasting. They are terms that are often unthinkingly used synonomously but such should not be the case. The exact meaning of superpower was detailed before in this article. Super-broadcasting is something still different and might be accomplished in one of two main ways. The first of these is the linking together by land telephone lines of many ordinary broadcasting stations, one of which might be called the central or distributing station. At this point, a program would originate and be sent out on the air. Simultaneously the same program would go out over the telephone wires to the other stations from which it would again be broadcast. In this way, a large section of territory can be covered with only the expense incurred by the use of one studio and group of entertainers, although of course several separate power plants will be required, one at each actual broadcasting point.

Another way of accomplishing super-broadcasting is the use of a method similar to that just described, but different in that short wave radio transmission would be used in place of telephone lines. This would in reality be nothing more nor less than relay broadcasting. Either one of these two systems may replace the superpower schemes that are now under way or in practice. Only time can tell what is going to come about in the field of broadcasting in the near future and we will have to await any changes. At any rate, stick to your present receiving set if it is giving you good service and if it is not selective enough to satisfy you, try the system shown in Fig. 1. If you have a type of set similar to any one of those shown in Figs. 2, 3 and 4, you need not fear the installation of superpower stations as they will probably not affect you to any great degree, unless they are situated extremely close to your location.

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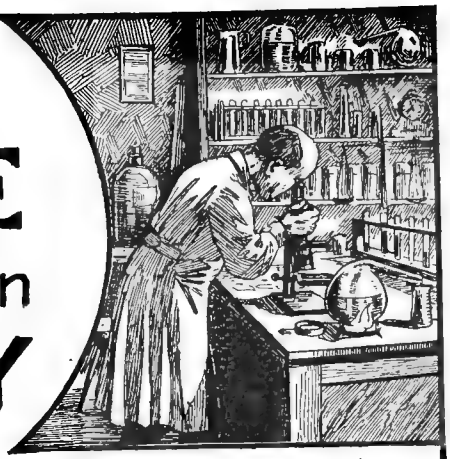

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I wish to express my appreciation of your prompt reply to my letter and to the recommendation to the General Electric Co. I intend to start the student engineering course at the works. This is somewhat along electrical lines, but the fact that I had a recommendation from a reliable school no doubt had considerable influence in helping me to secure the job.—H. VAN BENTHUYSEN.

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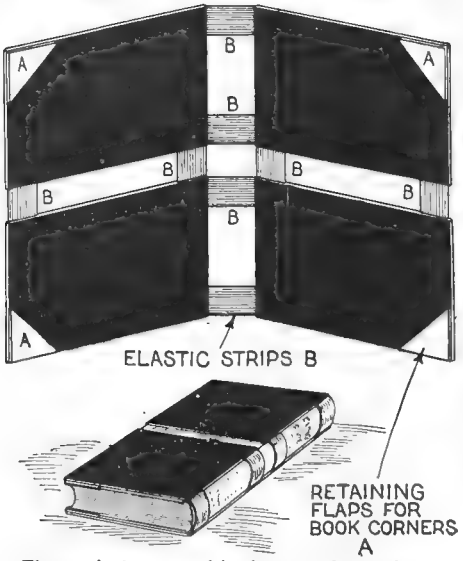
BOOK COVER

(909) G. W. Welland, Newberry, Mich., has designed a book cover upon which he desires our advice. The cover is made in four sections connected together by elastic strips so that the cover will fit any size of book.

A. 1. The book covers which you have designed are not new. As a matter of fact, five or six years ago, these things were sold extensively in colleges. We doubt if you could secure a patent upon this type of cover. The only difernece between the existing book covers and the one designed by you, is that no elastic strips are used, the covers themselves being coated on one edge with glue, whereupon it was merely necessary to moisten them and fasten them in place.

Q. 2. A window screen which is adjustable, not only to the width of the window, but also to the height has been designed by our correspondent. He desires our advice.



The particular type of book cover shown above is not new; application for a patent is not advisable.

A. 2. The window screen, in our opinion, is quite an interesting improvement, but you have not attempted to illustrate the construction of the screen portion of this device. It is evident that you will have to have a double slide effect, which in our opinion, makes it rather weak in construction.

We would suggest that you have a search made upon this device, and then that you try to get in touch with some concern who would be willing to place it upon the market. It would be advisable to protect the device as much as possible before doing the latter work, but unless you can secure the funds to finance the development of this type of screen, the patent will not be worth any more than the paper upon which it is written.

FLOAT VALVE

(910) A. C. Bradshaw, Los Angeles, Calif., submits a complete drawing of a proposed type of float valve upon which he asks our opinion.

A. 1. The one main objection that we have to your proposed float valve is that it is rather complicated and any small particles of dirt that get into the valve are very likely to cause a considerable amount of trouble. However, there are several novel features in your device and we would suggest that you have a reliable patent attorney conduct a search to see whether or not the device is patentable. If you then desire to invest any money in the device, you can apply for a patent. If you do not wish to do so, protect your device by filing an evidence of conception and take up the matter with one or two companies who handle valves of this type. If they believe that your device contains enough merit to make it a profitable venture, they would undoubtedly be willing to put the device on the market and pay you a royalty for the same.

RADIO HEADSET

(911) Fred E. Baskett, Nicholasville, Ky., sends us a model and complete description of a proposed type of headset for use of radio receivers and broadcast listeners. In this device the headband does not fit over the top of the head but goes under the chin and merely holds the phones to the ears by pressure rather than suspension. A pair of rubber ear caps are so placed as to aid in holding your receivers to the ears.

A. 1. We have received your rough model of an improved headset and have investigated it thoroughly. Frankly our report on the same is not favorable toward a patent application. The device as you have designed it, is far from satisfactory. The rubber ear caps are nothing new whatsoever, and are not designed in a manner that will allow the phones to fit on the ears and stay in position. Furthermore, the headband is a very crude and clumsy arrangement. It is far inferior to the headband of today as regards comfort and adaptability.

Furthermore, the ball-and-socket joint which you have designed, is by no means new. This form of joint has been used on many types of headbands heretofore.

Of course, some of your claims for this device seem well founded, but as far as we can say, the device is not comfortable, does not stay in position, does not do away with the usual phone cords and in its present form, we would absolutely advise against attempting to patent the device. The only way in which a headset of your design would give any satisfaction, whatsoever, would be to have the phones extremely light-weight and small sized that could fit within the ears. Phones of this nature have been devised and patented, although they have never met with very wide sale

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Radio As An Aid to Humanity

(*Continued from page* 541)

lifeboat, who more often than not will be a novice, can send out the latitude and longitude, the lifeboat is sure of being picked up.

Radio transmission of photographs has been one of the developments that has made possible many other applications. For instance, still considering the use of radio against criminals, finger prints and portraits of those who are "wanted" can be sent speedily from one city to another with the result that daily there are fewer criminals eluding the police.

Another great feature of the radio transmission of photographs is its use to medicine and surgery in general. For instance, in the very near future we may have with us the radio specialist who will receive, by means of special apparatus, photographs from physicians and surgeons in outlying districts who have not made the deep study of certain features of their work that the specialist has. The latter can then diagnose cases very readily from these photographs and transmit instructions to his co-worker who is in personal touch with the patient. Let us consider a specific example. As in the illustrations, a man has received a peculiar injury to his hand. The local physician cannot seem to do anything for him. Therefore, he takes an X-ray photograph of the hand, transmits it by radio to the specialist, who upon examining the received photograph, makes his diagnosis.

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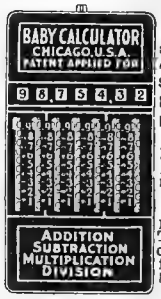

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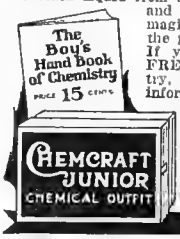

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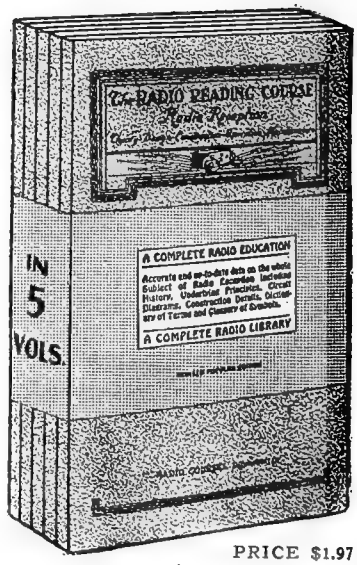

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Broadcast Calls

U. S., Canadian and Foreign
Revised to date:

First group of figures gives the power—second group indicates the wavelength.

Call Letters	Location and Name	Power & Wave Length
KDKA	East Pittsburgh, Pa., Westinghouse Electric & Mfg. Co.	Variable—309.1
KDLR	Devils Lake, N. D., Radio Electric Co. & Wilson Insurance Agency	5—231
KDPM	Cleveland, Ohio, Westinghouse Electric & Mfg. Co.	500—250
KDYL	Salt Lake City, Utah, Newhouse Hotel	50—246
KDZB	Bakersfield, Calif., Frank E. Siefert	100—209.7
KFAB	Lincoln, Neb., Nebraska Buick Auto Co.	500—240
KFAD	Phoenix, Ariz., McArthur Bros. Mercantile Co.	100—273
KFAE	Pullman, Wash., State College of Washington	500—348.6
KFAF	Denver, Colo., Western Radio Corp.	500—278
KFAJ	Boulder, Colo., University of Colorado	100—261
KFAN	Moscow, Idaho, University of Idaho	50—231
KFAU	Boise, Idaho, Boise High School	500—278
KFAW	Santa Ana, Calif., The Radio Den	10—214.2
KFBB	Havre, Mont., F. A. Buttrey & Co.	50—275
KFBC	San Diego, Calif., W. K. Azbill	10—224
KFBG	Tacoma, Wash., First Presbyterian Church	50—250
KFBK	Sacramento, Calif., Kimball-Upson Co.	100—248
KFBL	Everett, Wash., Leese Bros.	50—224
KFCB	Phoenix, Ariz., Nielson Radio Supply Co.	50—238
KFCF	Walla Walla, Wash., Frank A. Moore	100—258
KFCY	Le Mars Iowa, Western Union College	50—252
KFCZ	Omaha, Nebr., Omaha Central High School	50—258
KFDD	Boise, Idaho, St. Michaels Cathedral	50—278
KFDH	Tucson, Ariz., University of Arizona	50—258
KFDJ	Corvallis, Ore., Oregon Agricultural College	50—254
KFDM	Beaumont, Tex., Magnolia Petroleum Co.	500—315.6
KFDX	Shreveport, La., First Baptist Church	100—250
KFDY	Brookings, S. Dak., South Dakota State College of Agriculture and Mechanic Arts	100—273
KFDZ	Minneapolis, Minn., Harry O. Iverson	10—231
KFEC	Portland, Ore., Meier & Frank Co.	50—248
KFEL	Denver, Colo., Winner Radio Corp.	50—254
KFEQ	Oak, Nebr., Scroggin & Co. Bank	500—268
KFEY	Kellogg, Idaho, Bunker Hill & Sullivan Mining & Concentrating Co.	10—233
KFFP	Moberly, Mo., First Baptist Church	50—266
KFFR	Sparks, Nev., Nevada State Journal	10—226
KFFV	Lamoni, Iowa, Graceland College	100—250
KFFY	Alexandria, La., Louisiana College	50—275
KFGC	Baton Rouge, La., Louisiana State University	100—268
KFGD	Chickasha, Okla., Oklahoma College for Women (J. A. Teeters)	200—252
KFGH	Stanford University, Calif., Leland Stanford Junior University	500—270
KFGQ	Boone, Iowa, Crary Hardware Co.	10—226
KFGX	Orange, Tex., First Presbyterian Church	500—250
KFHA	Gunnison, Colo., Western State College of Colorado	50—252
KFHL	Oskaloosa, Iowa, Penn College	10—240
KFI	Los Angeles, Calif., Earle C. Anthony (Inc.)	2000—468.5
KFIF	Portland, Ore., Benson Polytechnic Institute	100—248
KFIO	Spokane, Wash., North Central High School	100—266
KFIQ	Yakima, Wash., First Methodist Church	100—256
KFIU	Juneau, Alaska, Alaska Electric Light & Power Co.	10—226

(*Continued on page 573*)

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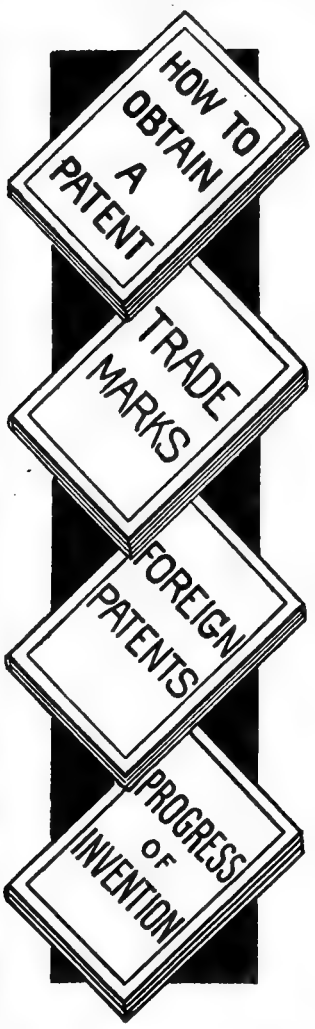

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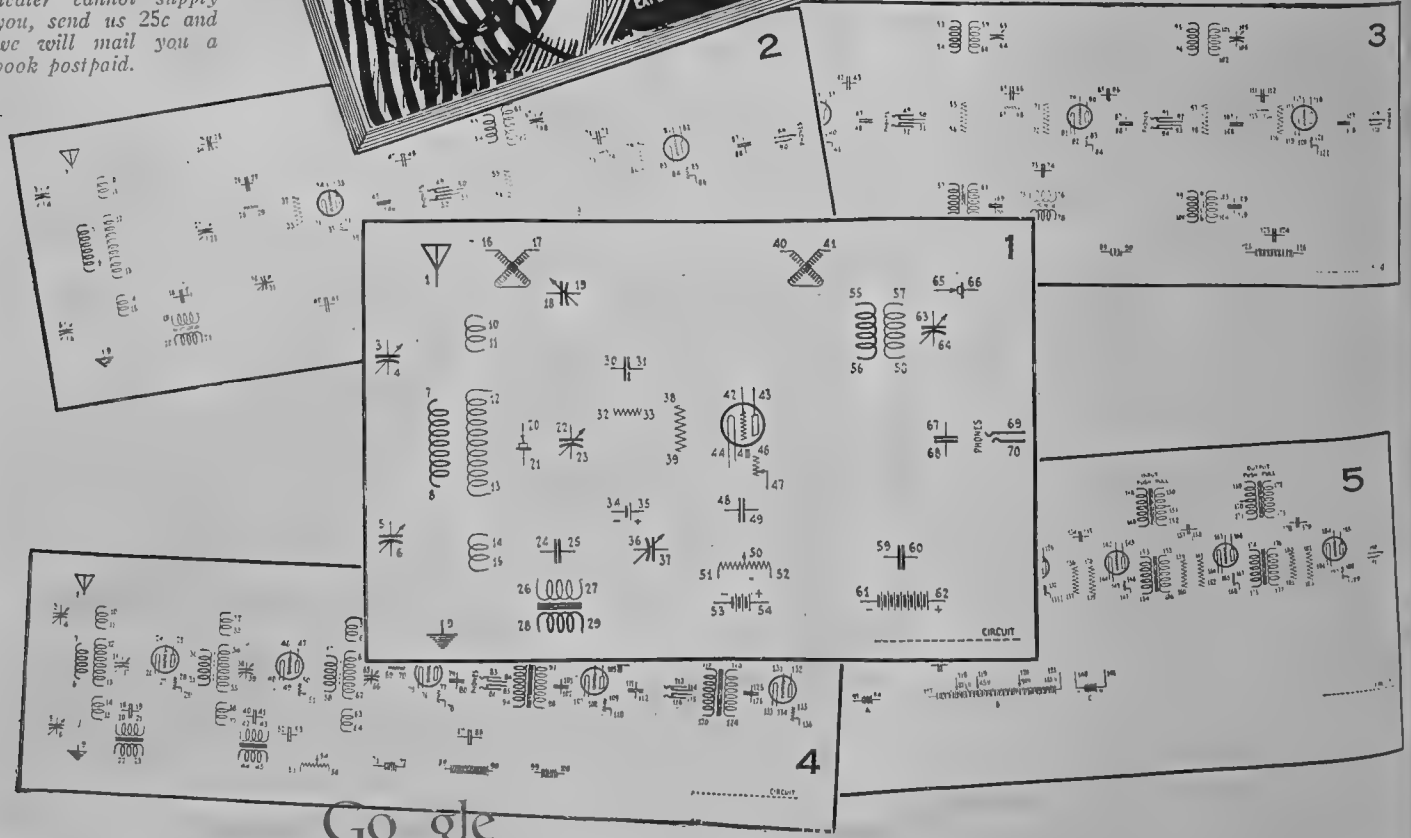

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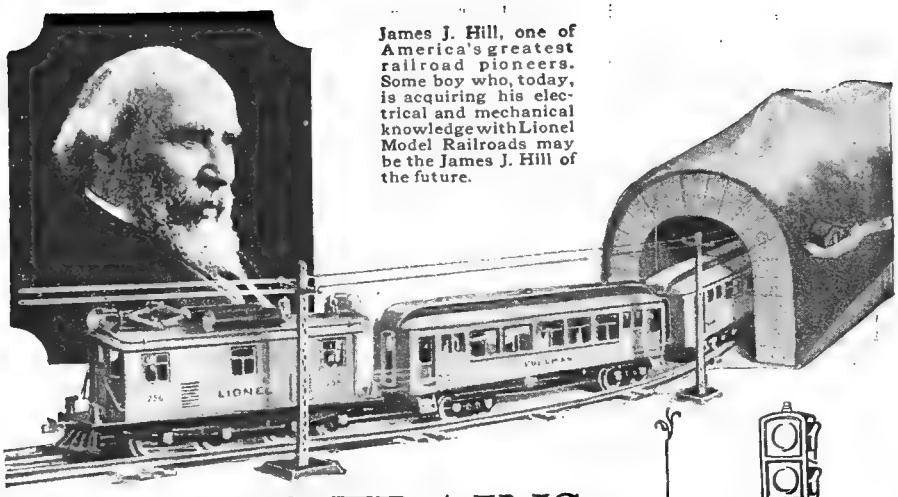
Broadcast Calls

(*Continued from page 571*)

Call Letters	Location and Name	Power & Wave Length
KFIZ	Fond du Lac, Wis., Daily Commonwealth & Seifert Radio Corp.	100—273
KFJB	Marshalltown, Iowa, Marshall Electric Co.	10—248
KFJC	Junction City, Kansas, Episcopal Church (R. B. Fegan)	10—218.8
KFJF	Oklahoma, Okla., National Radio Mfg. Co.	225—261
KFJI	Astoria, Ore., Liberty Theatre	10—246
KFJM	Grand Forks, N. Dak., University of North Dakota	100—278
KFJR	Portland, Oregon, Ashley C. Dixon & Son	5—263
KFJX	Cedar Falls, Iowa, Iowa State Teachers' College	50—258
KFJY	Fort Dodge, Iowa, Tunwall Radio Co.	50—246
KFKA	Greeley, Colo., Colorado State Teachers' College	50—273
KFKQ	Conway, Ark., Conway Radio Laboratories	100—250
KFKU	Lawrence, Kans., University of Kansas	500—275
KFKX	Hastings, Nebr., Westinghouse Electric & Mfg. Co.	2000—288.3
KFKZ	Kirksville, Mo., F. M. Henry	5—266
KFLP	Cedar Rapids, Iowa, Everette M. Foster	20—256
KFLR	Albuquerque, N. Mex., University of New Mexico	200—254
KFLU	San Benito, Tex., San Benito Radio Corp.	10—236
KFLV	Rockford, Ill., Swedish Evangelical Mission Church	100—229
KFLX	Galveston, Tex., George R. Clough	10—240
KFLZ	Atlantic, Iowa, Atlantic Automobile Co.	100—273
KFMQ	Fayetteville, Ark., University of Arkansas	500—299.8
KFMR	Sioux City, Iowa, Morningside College	100—261
KFMW	Houghton, Mich., M. G. Sateren	50—263
KFMX	Northfield, Minn., Carleton College	750—336.9
KFNF	Shenandoah, Iowa, Henry Field Seed Co.	500—266
KFNG	Coldwater, Miss., Wooten's Radio and Electric Shop	10—254
KFNJ	Warrensburg, Mo., Central Missouri State Teachers' College	50—234
KFNV	Santa Rosa, Calif., Battery & Radio Supply Shop (L. A. Drake)	50—229
KFOA	Seattle, Wash., Rhodes Dept. Store	500—454.3
KFOC	Whittier, Calif., First Christian Church	100—236
KFOJ	Moberly, Mo., Moberly High School	10—246
KFOL	Marengo, Iowa, Leslie M. Schafbuch	10—234
KFON	Long Beach, Calif., Echophone Radio Shop	100—233
KFOO	Salt Lake City, Utah, Latter Day Saints University	250—236
KFOR	David City, Nebr., David City Tire & Electric Co.	100—226
KFOT	Wichita, Kans., College Hill Radio Club (College Hill Methodist Church)	50—231
KFOX	Omaha, Nebr., Technical High School	100—248
KFOY	St. Paul, Minn., Beacon Radio Service	50—252
KFPG	Los Angeles, Calif, Oliver S. Garretson	100—238
KFPL	Dublin, Texas, C. C. Baxter	15—252
KFPM	Greenville, Texas, New Furniture Co.	10—242
KFPR	Los Angeles, Calif., Los Angeles County Forestry Department	500—231
KFPV	San Francisco, Calif., Heintz & Kohlmoos	50—236
KFPW	Carterville, Mo., St. Johns Church	20—258
KFPY	Spokane, Wash., Symons Investment Co.	100—266
KFQA	St. Louis, Mo., The Principia.	100—261
KFQB	Fort Worth, Texas, Searchlight Publishing Co.	150—263
KFQC	Taft, Calif., Kidd Brothers Radio Shop	100—231
KFQH	Burlingame, Calif., Radio Service Co. (Albert Sherman)	50—220
KFQP	Iowa City, Iowa, George S. Carson, Jr.	10—224
KFQR	Oklahoma, Okla., Walter L. Ellis	50—209.7
KFQT	Denison, Texas, Texas National Guard, 36th Signal Company	10—252
KFQU	Holy City, Calif., W. Riker	100—222



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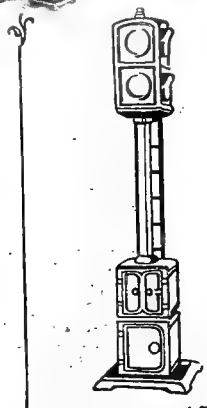

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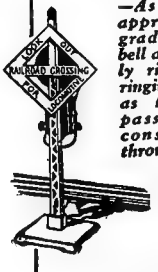

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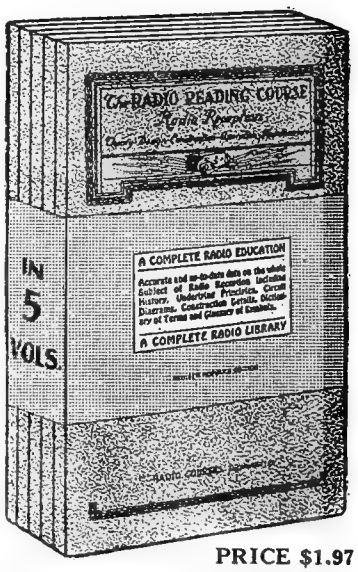
KFQY	Belden, Nebr., Farmers State Bank	10—273
KFQZ	Hollywood, Calif., Taft Radio Co.	250—240
KFRB	Beeville, Tex., Hall Brothers.	250—248
KFRC	San Francisco, Calif., City of Paris Dry Goods Co.	50—268
KFRH	Grafton, N. D., The Radio Shop (Martin L. Monson)	10—268
KFRL	Grand Forks, N. D., Men's Club of First Presbyterian Church	10—240
KFRM	Fort Sill, Okla., Lieut. James P. Boland, U. S. A.	50—263
KFRU	Bristow, Okla., Etherical Radio Co.	500—394.5
KFRW	Olympia, Wash., United Churches of Olympia	50—218.8
KFRX	Pullman, Wash., J. Gordan Klemgard	10—217.3
KFRY	State College, N. Mex., New Mexico College of Agriculture and Mechanic Arts.	50—266
KFRZ	Hartington, Neb., Electric Shop (P. M. Thies)	15—222
KFSG	Los Angeles, Calif., Echo Park Evangelistic Assn.	500—275
KFSY	Helena, Mont., Van Blaricom Co.	10—248
KFUJ	Breckenridge, Minn., Hoppert Plumbing & Heating Co.	50—242
KFUL	Galveston, Tex., Thomas Goggan & Bros. Music Co.	10—258
KFUM	Colorado Springs, Colo., W. D. Corley	100—242
KFUO	St. Louis, Mo., Concordia Seminary	500—545.1
KFUP	Denver, Colo., Fitzsimons General Hospital	50—234
KFUR	Ogden, Utah, H. W. Peery & C. Redfield	50—224
KFUS	Oakland, Calif., Louis L. Sherman	50—234
KFUT	Salt Lake City, Utah, University of Utah	100—261
KFUU	San Leandro, Calif., Colburn Radio Labs.	50—224
KFUV	Springfield, Mo., G. Pearson Ward	10—252
KFUY	Butte, Mont., Irving H. Bouchard	5—254
KFUZ	Virginia, Minn., Young Men's Christian Assn.	10—248
KFVC	Camden, Ark., Bensberg's Music Co.	10—242
KFVD	San Pedro, Calif., McWhinnie Electric Co.	50—205.4
KFVE	St. Louis, Mo., Film Corporation of America	500—240
KFVF	Hollywood, Calif., Clarence B. Juneau	50—208.2
KFVG	Independence, Kansas, First Methodist Epis. Church	10—236
KFVH	Manhattan, Kansas, Whan Radio Shop	10—218.8
KFVI	Houston, Texas, Fifty-sixth Brigade, Headquarters Troop	10—248
KFVJ	San Jose, Calif, First Baptist Church	500—226
KFVK	Sacramento, Calif., Chamber of Commerce	500—248
KFVL	Vancouver, Wash., Vancouver Barracks, U. S. Army.	5—231
KFVN	Welcome, Minn., Carl E. Bagley	10—227
KFVR	Denver, Colo., (near) Moonlight Ranch, Route 6, Eugene Rossi	50—246
KFVS	Cape Girardeau, Mo., Cape Girardeau Battery Station, Oscar C. Hirsch	50—224
KFVU	Eureka, Calif., Radio Shop, Pete Radelich	5—209.7
KFVW	San Diego, Calif., Airfan Radio Corp.	500—246
KFVX	Bentonville, Ark., Radio Shop, R. H. Porter	10—236
KFVY	Albuquerque, N. Mex., Radio Supply Co.	10—250
KFWA	Ogden, Utah, Browing Bros. Co.	500—261
KFWB	Hollywood, Calif., Warner Bros. Pictures (Inc.)	500—252
KFWD	Arkadelphia, Arkansas, Arkansas Light & Power Co.	500—266
KFWF	St. Louis, Mo., St. Louis Truth Center	250—214.2
KFWH	Chico, Calif., F. Wellington Morse, Jr.	100—254
KFWI	South San Francisco, Calif., Radio Entertainments (Inc.)	500—220
KGB	Tacoma, Wash., Tacoma Daily Ledger	50—250
KGO	Oakland, Calif., General Electric Co.	2000—361.2
KGTT	San Francisco, Calif., Glad Tidings Tabernacle	50—234
KGU	Honolulu, Hawaii, Marion A. Mulrony	500—270



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KHJ	Los Angeles, Calif., Times-Mirror Co.	500—405.2
KHQ	Seattle, Wash., Louis Wasmer (Excelsior Motorcycle & Bicycle Co.)	100—273
KJBS	San Francisco, Calif., Julius Brunton & Sons Co.	5—236
KJR	Seattle, Wash., Northwest Radio Service Co.	1000—384.4
KJS	Los Angeles, Calif., Bible Institute of Los Angeles	750—293.9
KLDS	Independence, Mo., Reorganized Church of Jesus Christ of Latter Day Saints	1000—440.9
KLS	Oakland, Calif., Warner Bros. Radio Supplies Co.	250—242
KLX	Oakland, Calif., Tribune Publishing Co.	500—508.2
KLZ	Denver, Colo., Reynolds Radio Co.	250—266
KMJ	Fresno, Calif., San Joaquin Light and Power Corp.	50—234
KMO	Tacoma, Wash., Love Electric Co.	100—250
KNX	Los Angeles, Calif., Los Angeles Express	500—336.9
KOA	Denver, Colo., General Electric Co.	2000—322.4
KOB	State College, N. M., New Mexico College of Agriculture and Mechanic Arts	750—348.6
KOP	Detroit, Mich., Detroit Police Department	500—278
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KPPC	Pasadena, Calif., Pasadena Presbyterian Church	50—229
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KQW	San Jose, Calif., Charles D. Herrold	50—226
KRE	Berkeley, Calif., Berkeley Daily Gazette	50—258
KSAC	Manhattan, Kans., Kansas State Agricultural College	500—340.7
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KTW	Seattle, Wash., First Presbyterian Church	750—454.3
KUO	San Francisco, Calif., Examiner Printing Co.	150—246
KUOM	Missoula, Mont., University of Montana	250—244
KWG	Stockton, Calif., Portable Wireless Telephone Co.	50—248
KWKC	Kansas City, Mo., Wilson Duncan Studios	100—236
KWKH	Shreveport, La., W. G. Patterson	250—273
KWWG	Brownsville, Texas, City of Brownsville, Board of City Development	500—278
KYW	Chicago, Ill., Westinghouse Electric & Mfg. Co.	1500—535.4
KZKZ	Manila, P. I., Electrical Supply Co.	100—270
KZM	Oakland, Calif., Preston D. Allen	100—242
KZRQ	Manila, P. I., Manila Hotel, Far Eastern Radio (Inc.)	500—222
WAAB	New Orleans, La., Valdemar Jensen	100—268
WAAC	New Orleans, La., Tulane University	100—275
WAAD	Cincinnati, Ohio, Ohio Mechanics Institute	25—258
WAAF	Chicago, Ill., Chicago Daily Drovers Journal	200—278
WAAM	Newark, N. J., I. R. Nelson Co.	250—263
WAAW	Omaha, Neb., Omaha Grain Exchange	500—278
WABA	Lake Forest, Ill., Lake Forest University	200—227
WABB	Harrisburg, Pa., Harrisburg Sporting Goods Co.	10—266
WABC	Asheville, N. C., Asheville Battery Co.	10—254
WABI	Bangor, Me., Bangor Hydro-Electric Co.	100—240
WABN	La Crosse, Wis., Ben A. Ott	500—244
WABO	Rochester, N. Y., Lake Avenue Baptist Church (Hickson Electric Co.)	100—278
WABQ	Haverford, Pa., Haverford College Radio Club	50—261
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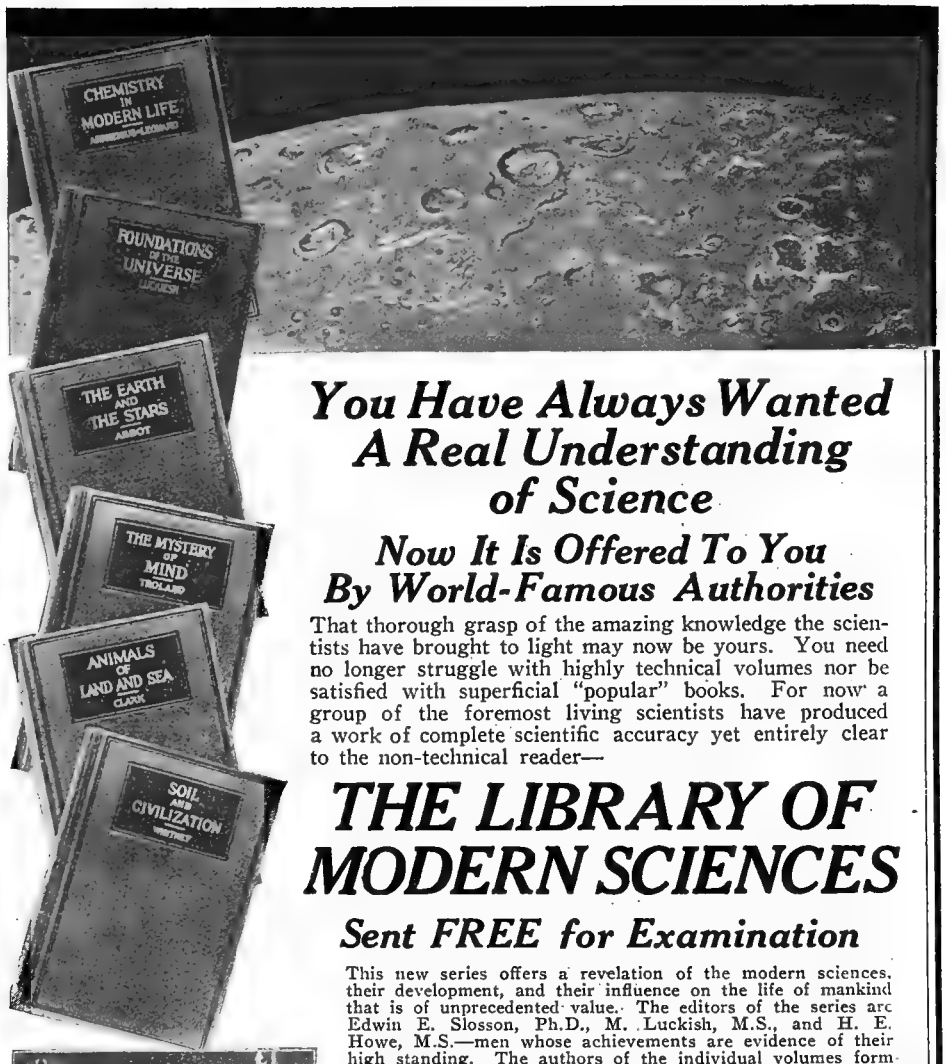

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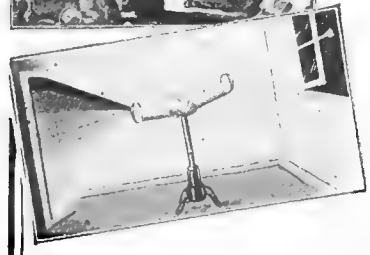

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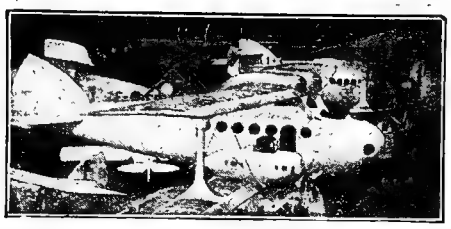

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WADC	Akron, Ohio, Allen Theater	100—258
WAFD	Port Huron, Mich., Albert B. Parfet Co.	500—256
WAHG	Richmond Hill, N. Y., A. H. Grebe & Co.	500—315.6
WAIT	Taunton, Mass., A. H. Wait & Co.	10—229
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WARC	Medford Hillside, Mass., American Radio Research Corp.	100—261
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WBAP	Fort Worth, Texas, Worthham-Carter Publishing Co. (Star-Telegram)	1000—475.9
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WCAH	Columbus, Ohio, Entrekin Electric Co.	500—266
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WCAL	Northfie'd, Minn., St. Olaf College	500—336.9
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WCAT	Rapid City, S. D., South Dakota State School of Mines	50—240
WCAU	Philadelphia, Pa., Durham & Co.	500—278
WCAX	Burlington, Vt., University of Vermont	100—250
WCAY	Milwaukee, Wis., Hotel Antlers, Milwaukee Civic Broadcasting Assn.	250—266
WCAZ	Carthage, Ill., Carthage College	50—246
WCBA	Allentown, Pa., Queen City Radio Station	15—254
WCBC	Ann Arbor, Mich., University of Michigan	200—229
WCBD	Zion, Ill., Wilbur G. Voliva	5000—344.6
WCBE	New Orleans, La., Uhalt Brothers Radio Co.	5—263
WCBG	Pascagoula, Miss. (portable), Howard S. Williams	10—268
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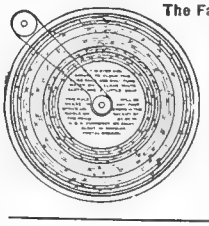

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WCCO	Minneapolis, Minn.,	Washburn-Crosby Co.	5000—416.4
WCEE	Elgin, Ill.,	Charles E. Erbstein	500—275.1
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WCTS	Worcester, Mass.,	C. T. Scherer Co.	500—268
WCUW	Worcester, Mass.,	Clark University	250—238
WCX	Detroit, Mich.,	Detroit Free Press	500—516.9
WDAE	Tampa, Fla.,	Tampa Daily Times	250—273
WDAF	Kansas City, Mo.,	Kansas City Star	500—365.6
WDAG	Amarilla, Texas,	J. Laurance Martin	100—263
WDAH	El Paso, Texas,	Trinity Methodist Church (South)	50—268
WDAY	Fargo, N. D.,	Radio Equipment Corporation	50—261
WDBC	Lancaster, Pa.,	Kirk, Johnson & Co.	50—258
WDBE	Atlanta, Ga.,	Gilham-Schoen Electric Co.	100—278
WDBJ	Roanoke, Va.,	Richardson-Wayland Electrical Corporation	50—229
WDBK	Cleveland, Ohio,	M. & F. Broz Furniture, Hardware & Radio Store	100—227
WDBO	Winter Park, Fla.,	Rollins College	100—240
WDBQ	Salem, N. J.,	Morton Radio Supply Co.	10—234
WDBR	Boston, Mass.,	Tremont Temple Baptist Church	100—261
WDBX	New York, N. Y.,	Otto Baur.	50—233
WDBY	Chicago, Ill.,	North Shore Congregational Church	500—258
WDBZ	Kingston, N. Y.,	Boy Scouts of America (Ulster County Council)	10—233
WDOD	Chattanooga, Tenn.,	Chattanooga Radio Co.	50—256
WDWF	Cranston, R. I.,	Dutee W. Flint	500—440.9
WDZ	Tuscola, Ill.,	James L. Bush	10 and 100—278
WEAA	Flint, Mich.,	Police Building, Frank D. Fallain	100—234
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WEAH	Wichita, Kans.,	Wichita Board of Trade	100—268
WEAI	Ithaca, N. Y.,	Cornell University	500—254
WEAJ	Vermilion, S. Dak.,	University of South Dakota	100—278
WEAM	North Plainfield, N. J.,	Borough of North Plainfield	250—261
WEAN	Providence, R. I.,	Shepard Co.	250—270
WEAO	Columbus, Ohio,	Ohio State University	500—293.9
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WEBA	Highland Park, N. J.,	The Electric Shop	15—233
WEBC	Superior, Wis.,	Walter C. Bridges	100—242
WEBD	Anderson, Ind.,	Electrical Equipment & Service Co.	10—246
WEBE	Cambridge, Ohio,	Roy W. Waller	10—234
WEBH	Chicago, Ill.,	Edgewater Beach Hotel Co.	1000—370.2
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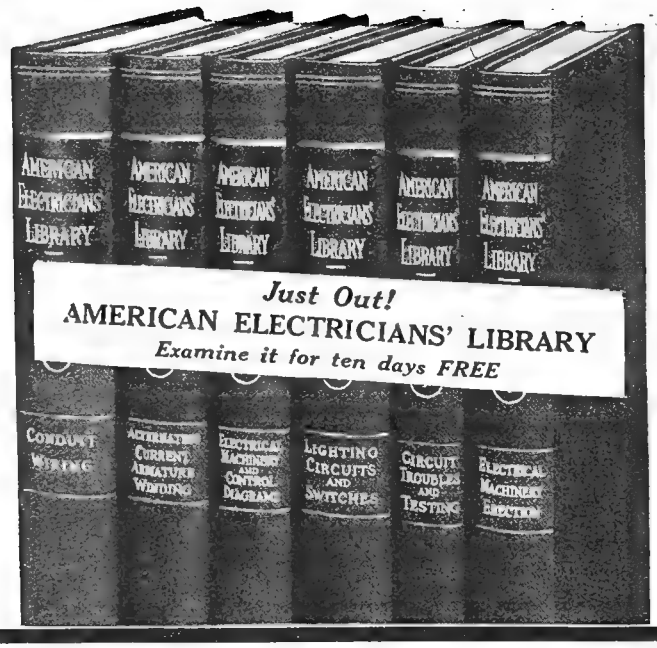
WEBK	Grand Rapids, Mich.,	Grand Rapids Radio Co.	20—242
WEBL	New York, N. Y.,	Woolworth Bldg., United States (portable), R. C. A.	100—226
WEBM	United States (portable),	Woolworth Bldg., N. Y.	100—226
WEBQ	Harrisburg, Ill.,	Tate Radio Co.	10—226
WEBR	Buffalo, N. Y.,	H. H. Howell	50—244
WEBT	Dayton, Ohio,	Dayton Cooperative Industrial High School	5—256
WEBW	Beloit, Wis.,	Beloit College	500—268
WEBZ	Savannah, Ga.,	Savannah Radio Corp.	50—263
WEEI	Boston, Mass.,	Edison Electric Illuminating Co. of Boston	500—475.9
WEHS	Evanston, Ill.,	Evanston Township High School	20—202.6
WEMC	Berrien Springs, Mich.,	Emmanual Missionary College	500—285.5
WENR	Chicago, Ill.,	All American Radio Corp.	100—266
WEW	St. Louis, Mo.,	St. Louis Uni-	



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Call Letters	Location and Name	Power & Wave Length
WFAA	Dallas, Tex., Dallas News & Dallas Journal	500—475.9
WFAM	St. Cloud, Minn., Times Publishing Co.	10—273
WFAV	Lincoln, Nebr., University of Nebraska	500—275
WFBC	Knoxville, Tenn., First Baptist Church	50—250
WFBD	Philadelphia, Pa., Gethsemane Baptist Church	5—234
WFBE	Seymour, Ind., John Van de Walle	10—226
WFBG	Altoona, Pa., William F. Gable Co.	100—278
WFBH	New York, N. Y., Hotel Majestic (Concourse Radio Corp.)	500—273
WFBI	Camden, N. J., Galvin Radio Supply Co.	250—236
WFBJ	Collegeville, Minn., St. John's University	50—236
WFBK	Hanover, N. H., Dartmouth College	100—256
WFBL	Syracuse, N. Y., Onondaga Hotel	100—252
WFBM	Indianapolis, Ind., Merchants Heat & Light Co.	250—268
WFBN	Bridgewater, Mass., Radio Sales & Service Co.	10—226
WFBQ	Raleigh, N. C., Wynne Radio Co.	50—252
WFBR	Baltimore, Md., Fifth Infantry, Maryland, N. G.	100—254
WFBY	Fort Benjamin Harrison, Ind., U. S. Army, Fifth Corps Area	100—258
WFBZ	Galesburg, Ill., Knox College	20—254
WFI	Philadelphia, Pa., Strawbridge & Clothier	500—394.5
WFKB	Chicago, Ill., Francis K. Bridgman	200—217.3
WGAL	Lancaster, Pa., Lancaster Electric Supply & Construction Co.	10—248
WGAZ	South Bend, Ind., South Bend Tribune	250—275
WGBA	Baltimore, Md., Jones Electric & Radio Mfg. Co.	100—254
WGBB	Freeport, N. Y., Harry H. Carman	100—244
WGBC	Memphis, Tenn., First Baptist Church	10—266
WGBF	Evansville, Ind., Finke Furniture Co.	100—236
WGBG	Thrifton, Va., Breitenbach's Radio Shop	10—226
WGBH	Fall River, Mass., Fall River Herald Publishing Co.	10—209.7
WGBI	Scranton, Pa., Frank S. Megargee	10—240
WGBK	Johnstown, Pa., Lawrence W. Campbell (Fontaine Chateau)	5—248
WGBL	Elyria, Ohio, Elyria Radio Assoc.	10—227
WGBM	Providence, R. I., Theodore N. Saaty	5—234
WGBQ	Menomonie, Wis., Stout Institute	100—234
WGBR	Marshfield, Wis., Marshfield Broadcasting Assn.	10—229
WGBS	New York, N. Y., Gimbel Brothers	500—315.6
WGBT	Greenville, S. C., Furman University	15—236
WGBU	Miami, Fla., Florida Cities Finance Co.	500—384.4
WGBW	Spring Valley, Ill., Valley Theater	10—256
WGBX	Orono, Me., University of Maine	100—252
WGBY	New Lebanon, Ohio, Progress Sales Co.	30—250
WGCP	Newark, N. J., Grand Central Palace	500—252
WGES	Oak Park, Ill., Coyne Elec. School	500—250
WGHP	Detroit, Mich., George H. Phelps	500—270
WGMU	Richmond Hill, N. Y. (portable) A. H. Grebe & Co.	100—236
WGN	Chicago, Ill., The Tribune (Drake Hotel - Whitestone Co.)	1000—370.2
WGR	Buffalo, N. Y., Federal Telep. Mfg. Co.	750—319
WGST	Atlanta, Ga., Georgia School of Technology	500—270
WGY	Schenectady, N. Y., General Electric Co.	2000—379.5
WHA	Madison, Wisconsin, University of Wisconsin	750—535.4
WHAD	Milwaukee, Wis., Marquette University	500—275
WHAG	Cincinnati, Ohio, University of Cincinnati	100—233
WHAM	Rochester, N. Y., University of Rochester (Eastman School of Music)	100—278
WHAP	Brooklyn, N. Y., Wm. H. Taylor Finance Corp.	100—240
WHAR	Atlantic City, N. J., Seaside House Hotel	500—275

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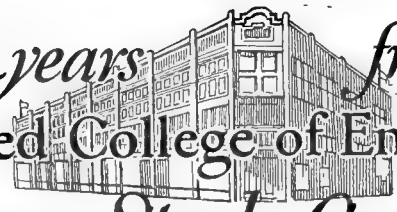
Call Letters	Location and Name	Power & Wave Length
WHAS	Louisville, Ky., Courier-Journal & Louisville Times	500—399.8
WHAT	Minneapolis, Minn., George W. Young	500—263
WHAV	Wilmington, Del., Wilmington Electrical Specialty Co.	100—266
WHAZ	Troy, N. Y., Rennselaer Polytechnic Institute	500—379.5
WHB	Kansas City, Mo., Sweeney School Co.	500—365.6
WHBA	Oil City, Pa., Shaffer Music House	10—250
WHBB	Stevens Point, Wis., Copps Co.	50—240
WHBC	Canton, Ohio, Rev. E. P. Graham	10—254
WHBD	Bellefontaine, Ohio, Chas. W. Howard	20—222
WHBF	Rock Island, Ill., Beardsley Specialty Co.	100—222
WHBG	Harrisburg, Pa., John S. Skane	20—231
WHBH	Culver, Ind., Culver Military Academy	100—222
WHBJ	Fort Wayne, Ind., Lane Auto Co.	10—234
WHBK	Ellsworth, Me., Franklin Street Garage	10—231
WHBL	Logansport, Ind., James H. Slusser	50—215.7
WHBM	Chicago, Ill., C. L. Carrell	20—233
WHBN	St. Petersburg, Fla., First Ave. Methodist Church	10—238
WHBO	Pawtucket, R. I., Young Men's Christian Assoc.	50—231
WHBP	Johnstown, Pa., Johnstown Automobile Co.	100—256
WHBQ	Memphis, Tenn., Men's Fellowship Class of St. John's M. E. Church South	50—233
WHBR	Cincinnati, Ohio, Scientific Electric & Mfg. Co.	20—215.7
WHBS	Mechanicsburg, Ohio, Edward W. Locke	10—208.2
WHBU	Anderson, Ind., B. L. Bing's Sons	10—218.8
WHBV	Columbus, Ga., Fred Rays Radio Shop	20—244
WHBW	Philadelphia, Pa., D. R. Kienzle	100—215.7
WHBX	Punxsutawny, Pa., J. W. Bowser	50—212.6
WHBY	West De Pere, Wis., St. Norbert's College	50—250
WHDI	Minneapolis, Minn., William Hood Dunwoody Industrial Institute	500—278
WHEC	Rochester, N. Y., Hickson Electric Co.	100—258
WHK	Cleveland, Ohio, Radiovox Co. (Warren R. Cox)	250—273
WHN	New York, N. Y., George Schubel	500—361.2
WHO	Des Moines, Iowa, Bankers Life Co.	500—526
WHT	Deerfield, Ill., Radiophone Broadcasting Corp.	1500—238
WIAD	Ocean City, N. J., Howard R. Miller	100—250
WIAK	Omaha, Nebr., Journal-Stockman Co.	250—278
WIAS	Burlington, Iowa, Home Electric Co.	100—254
WIBA	Madison, Wis., Capital Times Studio	100—236
WIBC	St. Petersburg, Fla., L. M. Tate Post No. 39, Veterans of Foreign Wars	100—222
WIBD	Joliet, Ill., X-L Radio Service	50—200
WIBE	Martinsburg, W. Va., Appolo Theatre, Martinsburg Radio Broadcasting Co.	5—209.7
WIBF	Wheatland, Wis., S. P. Miller Dance Activities	50—231
WIBG	Elkins Park, Pa., St. Paul's Protestant Episcopal Church	50—222
WIBH	New Bedford, Mass., Elite Radio Stores, James T. Moriarty	5—209.7
WIBI	Flushing, N. Y., Frederick B. Zittell, Jr.	5—218.8
WIBJ	Chicago, Ill., (Portable) C. K. Carrell	50—215.7
WIBK	Toledo, Ohio, University of the City of Toledo	100—205.4
WIBL	Chciago, Ill., (portable) McDonald Radio Co.	250—215.7
WIBM	Chicago, Ill. (portable) Billy Maine	10—215.7
WIBO	Chicago, Ill., Nelson Bros., (Russo & Tiorito Orchestra Exchange	500—226
WIBP	Meridan, Miss., First Presbyterian Church	5—209.7
WIBQ	Farina, Ill., F. M. Schmidt	5—205.4
WIBR	Weirton, W. Va., Thurman A. Owings	50—246
WIBS	Elizabeth, N. J., (portable) N. J. Nat'l. Guard, 57th Infantry Brigade	20—202.6
WIL	St. Louis, Mo., St. Louis Star & Benson Radio Co.	250—273
WIP	Philadelphia, Pa., Gimbel Brothers	500—508.2
WJAD	Waco, Tex., Jackson's Radio Engineering Laboratories	500—382.7

For 22 years  *from this*

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WJAK	Greentown, Ind., Clifford L. White	100—254
WJAM	Cedar Rapids, Iowa, D. M. Perham	100—268
WJAR	Providence, R. I., The Outlet Co. (J. Samuels & Bro.)	500—305.9
WJAS	Pittsburgh, Pa., Pittsburgh Radio Supply House	500—275
WJAZ	Chicago, Ill., Zenith Radio Corp.	100—268
WJBA	Joliet, Ill., D. H. Lentz, Jr.	50—206.8
WJBB	St. Petersburg, Fla., L. W. McClung	10—206.8
WJBC	La Salle, Ill., Hummer Furniture Co.	100—234
WJBD	Ashland, Wis., Ashland Broadcasting Committee	100—233
WJBI	Joliet, Ill., H. M. Couch	100—214.2
WKBG	Chicago, Ill., (portable) C. L. Carrell	100—215.7
WJD	Granville, Ohio, Denison University	10—217.3
WJJD	Mooseheart, Ill., Supreme Lodge, Loyal Order of Moose	500—302.8
WJY	New York, N. Y., R. C. A.	1000—405.2
WJZ	New York, N. Y., R. C. A.	1000—454.3
WKAA	Cedar Rapids, Iowa, H. F. Paar	50—278
WKAD	East Providence, R. I., Charles Looff (Crescent Park)	20—240
WKAP	Cranston, R. I., Dutee W. Flint	50—234
WKAQ	San Juan, P. R., Radio Corp. of Porto Rico	500—340.7
WKAR	East Lansing, Mich., Michigan Agricultural College	750—285.5
WKAV	Laconia, N. H., Laconia Radio Club	50—209.7
WKBE	Webster, Mass., K & B Electric Co.	10—231
WKRC	Cincinnati, Ohio, Kodel Radio Corp.	1000—325.9
WKY	Oklahoma, Okla., WKY Radio Shop	100—275
WLAL	Tulsa, Okla., First Christian Church	150—250
WLAP	Louisville, Ky., W. V. Jordan	20—275
WLAX	Greencastle, Ind., Greencastle Community Broadcasting Station	10—231
WLB	Minneapolis, Minn., University of Minnesota	500—278
WLBL	Stevens Point, Wis., Wisconsin Department of Markets	500—278
WLIT	Philadelphia, Pa., Lit Bros.	500—394.5
WLS	Chicago, Ill., Sears, Roebuck & Co.	500—344.6
WLTS	Chicago, Ill., Lane Technical High School	100—258
WLW	Harrison, Ohio, Crosley Radio Corp.	500 & 5000—422.3
WMAC	Cazenovia, N. Y., Clive B. Meredith	100—275
WMAF	Dartmouth, Mass., Round Hills Radio Corp.	100—500—360
WMAK	Lockport, N. Y., Norton Laboratories	500—466
WMAN	Columbus, Ohio, First Baptist Church (W. E. Heskett)	50—278
WMAQ	Chicago, Ill., Chicago Daily News	500—447.5
WMAY	St. Louis, Mo., Kingshighway Presbyterian Church	100—248
WMAZ	Macon, Ga., Mercer University	500—261
WMBB	Chicago, Ill., American Bond & Mortgage Co.	500—250
WMBF	Miami Beach, Fla., Fleetwood Hotel	500—384.4
WMC	Memphis, Tenn., "Commercial Appeal"	500—499.7
WMCA	New York, N. Y., Hotel McAlpin (Greeley Square Hotel Co.)	500—340.7
WMU	Washington, D. C., Doubleday-Hill Electric Co.	50—261
WNAB	Boston, Mass., Shepard Stores	100—250
WNAC	Boston, Mass., Shepard Stores	500—280.2
WNAD	Norman, Okla., University of Oklahoma	250—254
WNAL	Omaha, Nebr., Omaha Central High School	50—258
WNAP	Springfield, Ohio, Wittenberg College	100—248
WNAR	Butler, Mo., First Christian Church	20—231
WNAT	Philadelphia, Pa., Lenning Brothers Co.	100—250
WNAV	Knoxville, Tenn., Peoples Telephone & Telegraph Co.	500—233
WNAX	Yankton, S. Dak., Dakota Radio Apparatus Co.	100—244
WNJ	Newark, N. J., Radio Shop of Newark	100—233
WNYC	New York, N. Y., City of New York	1000—526
WOAC	Lima, Ohio, Page Organ Co.	50—261
WOAI	San Antonio, Tex., Southern Equipment Co.	1000—394.5
WOAN	Lawrenceburg, Tenn., James D. Vaughn	500—282.8
WOAW	Omaha, Nebr., Woodmen of the World	1000—526

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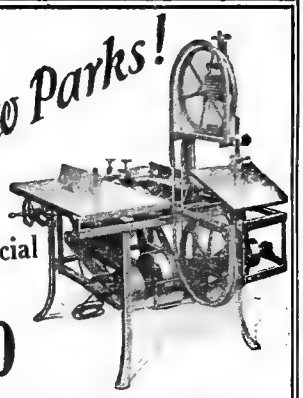

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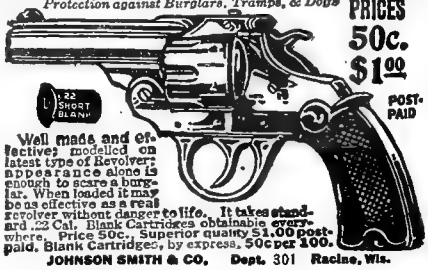

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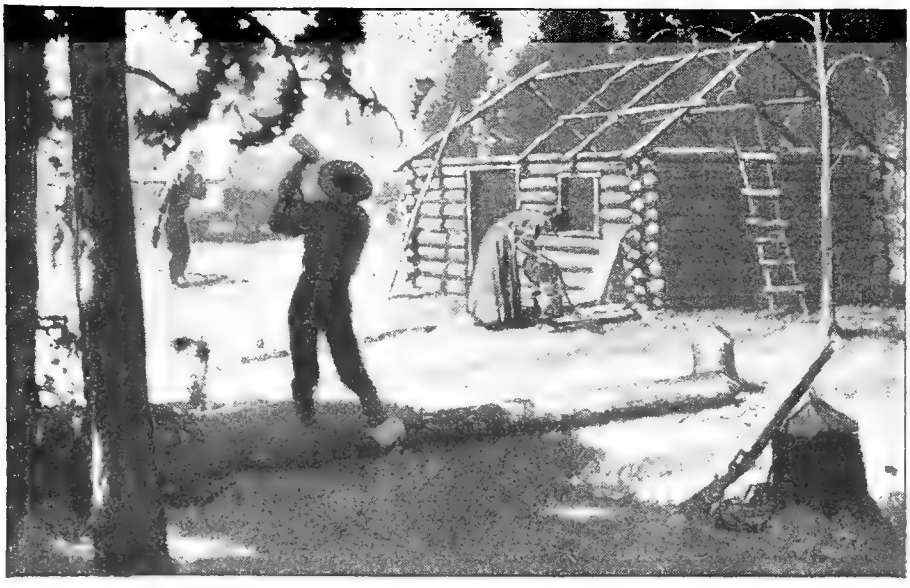
WOAX	Trenton, N. J., Franklyn J. Wolff	50—240
WOC	Davenport, Iowa, Palmer School of Chiropractic	5000—483.6
WOCL	Jamestown, N. Y., Hotel Jamestown	15—275
WODA	Paterson, N. J., James K. O'Dea Radio & Victrola Shop	25—224
WOI	Ames, Iowa, Iowa State College	500—270
WOK	Homewood, Ill., Neutrowound Radio Mfg. Co.,	50—217.3
WOO	Philadelphia, Pa., John Wanamaker	500—508.2
WOQ	Kansas City, Mo., Unity School of Christianity	500—278
WOR	Newark, N. J., L. Bamberger & Co.	500—405.2
WORD	Batavia, Ill., Peoples Pulpit Association	2000—275
WOS	Jefferson City, Mo., Missouri State Marketing Bureau	500—440.9
WOWL	New Orleans, La., Owl Battery Co.	100—270
WOWO	Fort Wayne, Ind., Main Auto Supply Co.	500—227
WPAJ	New Haven, Conn., Doolittle Radio Corp.	100—268
WPAK	Agricultural College, N. Dak., North Dakota Agricultural College	50—275
WPAZ	Charleston, W. Va., John R. Koch (Dr.)	10—268
WPG	Atlantic City, N. J., Municipality of Atlantic City	500—299.8
WPSC	State College, Penna., Pennsylvania State College	500—261
WQAA	Parkesburg, Pa., Horace A. Beale, Jr.	500—220
WQAC	Amarillo, Tex., Gish Radio Service	100—234
WQAE	Springfield, Vt., Moore Radio News Station	50—246
WQAM	Miami, Fla., Electrical Equipment Co.	100—268
WQAN	Scranton, Pa., Scranton Times	100—250
WQAO	New York, N. Y., Calvary Baptist Church	100—360
WQAS	Lowell, Mass., Prince-Walter Co.	100—252
WQJ	Chicago, Ill., Calumet Rainbow Broadcasting Co.	500—447.5
WRAA	Houston, Tex., Rice Institute.	100—256
WRAF	Laporte, Ind., The Radio Club	100—224
WRAK	Escanaba, Mich., Economy Light Co.	100—256
WRAM	Galesburg, Ill., Lombard College	100—244
WRAV	Yellow Springs, Ohio, Antioch College	100—263
WRAW	Reading, Pa., Avenue Radio & Electric Shop	10—238
WRAX	Gloucester City, N. J., Flexon's Garage	250—268
WRBC	Valparaiso, Ind., Immanuel Lutheran Church	500—278
WRC	Washington, D. C., Radio Corp. of America	1000—468.5
WREO	Lansing, Mich., Reo Motor Car Co.	500—285.5
WRHF	Washington, D. C., Washingington Radio Hospital Fund	50—256
WRK	Hamilton, Ohio, Doron Bros. Electrical Co.	200—270
WRM	Urbana, Ill., University of Illinois	500—273
WRNY	New York, N. Y., Experimenter Publishing Co.	500—258
WRR	Dallas, Tex., City of Dallas, Police and Fire Signal Department	350—261
WRW	Tarrytown, N. Y., Tarrytown Radio Research Laboratory	500—273
WSAC	Clemson College, S. C., Clemson Agricultural College	500—336.9
WSAD	Providence, R. I., J. A. Foster Co.	100—256
WSAG	St. Petersburg, Fla., Gospel Tabernacle	500—266
WSAI	Mason, Ohio, United States Playing Card Co.	5000—325.9
WSAJ	Grove City, Pa., Grove City College	250—229
WSAN	Allentown, Pa., Allentown Call Publishing Co.	100—229
WSAR	Fall River, Mass., Doughty & Welch Electrical Co.	100—254
WSAU	Chesham, N. H., Camp Marienfeld	10—229
WSAV	Houston, Tex., Clifford W. Vick Radio Construction Co.	100—248
WSAZ	Pomeroy, Ohio, Chase Electric Shop	50—244
WSB	Atlanta, Ga., Atlanta Journal	500—428.3
WSBC	Chicago, Ill., World Battery Co.	200—209.7
WSBF	St. Louis, Mo., Stix Baer & Fuller	100—273
WSDA	New York, N. Y., City Temple	250—263
WSKC	Bay City, Mich., Worlds Star Knitting Co.	100—261
WSMB	New Orleans, La., Saenger Amusement & Maison Blanche Co.	500—319



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WSMH	Owosso, Mich., Shattuck Music House	10—240
WSMK	Dayton, Ohio, S.M.K. Radio Corp.	5—275
WSOE	Milwaukee, Wis., School of Engineering of Milwaukee	100—246
WSRF	Broadlands, Ill., Harden Sales & Service	10—233
WSRO	Hamilton Ohio, Radio Co. (Harry W. Fahrlander)	100—252
WSUI	Iowa City, Iowa, State University of Iowa	500—483.6
WSY	Auburn, Ala., Alabama Polytechnic Institute	500—250
WTAB	Fall River, Mass., Fall River Daily Herald Publishing Co.	100—266
WTAC	Johnstown, Pa., Penn. Traffic Co.	100—209.7
WTAL	Toledo, Ohio, Toledo Radio & Electric Co.	10—252
WTAM	Cleveland, Ohio, Willard Storage Battery Co.	2500—389.4
WTAP	Cambridge, Ill., Cambridge Radio & Electric Co.	50—242
WTAQ	Osseo, Wis., S. H. Van Gorden & Son	100—254
WTAR	Norfolk, Va., Reliance Electric Co.	100—261
WTAS	Elgin, Ill. (near), Charles E. Erbstein	1500—302.8
WTAT	Boston, Mass. (portable), Edison Elec. Illuminating Co.	100—244
WTAW	College Station, Tex., Agricultural & Mechanical College of Texas	250—270
WTAX	Streator, Ill., Williams Hardware Co.	50—231
WTAZ	Lambertville, N. J., Thomas J. McGuire	15—261
WTG	Manhattan, Kans., Kansas State Agricultural College	50—273
WTHS	Flint, Mich., Flint Senior High School	250—218.8
WTIC	Hartford, Conn., Travelers Insurance Co.	500—348.6
WWAD	Philadelphia, Pa., Wright & Wright, Inc.	100—250
WWAE	Plainfield, Ill., Lawrence J. Crowley (Alamo Ball Room)	500—242
WWAO	Houghton, Mich., Michigan College of Mines	250—263
WWI	Dearborn, Mich., Ford Motor Co.	500—266
WWJ	Detroit, Mich., Detroit News.	500—352.7
WWL	New Orleans, La., Loyola University	100—275

CANADIAN STATIONS

CFAC	Calgary, Alberta, The Calgary Herald	2000—434.5
CFCA	Toronto, Ontario, Star Publishing & Printing Co.	2000—356.9
CFCF	Montreal, Quebec, Marconi Wireless Teleg. Co. of Canada (Ltd.)	7500—410.7
CFCH	Iroquois Falls, Ontario, Abitibi Power & Paper Co. (Ltd.)	500—499.7
CFCK	Edmonton, Alberta, Radio Supply Co. (Ltd.)	400—516.9
CFCN	Calgary, Alberta, W. W. Grant Radio (Ltd.)	3000—434.5
CFCQ	Vancouver, British Columbia, Radio Specialties (Ltd.)	40—410.7
CFCU	Hamilton, Ontario, Jack V. Elliott (Ltd.)	200—340.7
CFKC	Thorold, Ontario, D. J. Fendell	150—248.0
CFQC	Saskatoon, Saskatchewan, The Electric Shop (Ltd.)	500—329.5
CFRC	Kingston, Ontario, Queens University (Dept. Electrical Engineering)	—
CFXC	New Westminster B. C., Westminister Trust Co.	80—291.1
CFYC	Municipality of Burnaby B. C., Radio Corp. of Vancouver (Ltd.)	2000—410.7
CHNC	Toronto, Ontario, Toronto Radio Research Society	2000—356.9
CHUC	Saskatoon, Saskatchewan, Intl. Bible Students' Ass'n.	—
CHXC	Ottawa, Ontario, J. R. Booth, Jr.	1200—434.5
CHYC	Montreal, Quebec, Northern Elec. Co. (Ltd.)	2000—410.7
CJCA	Edmonton, Alberta, Edmonton Journal (Ltd.)	5000—516.9
CJCD	Toronto, Ontario, The E. Eaton Co. (Ltd.)	100—356.9
CJCF	Kitchener, Ontario, The News Record	300—329.5
CJGC	London, Ontario, London Free Press Printing Co.	200—329.5
CKAC	Montreal, Quebec, La Press Pub. Co., Ltd.	7500—410.7
CKCD	Vancouver, B. C., Vancouver Daily Province	6000—410.7
CKCK	Regina, Saskatchewan, Leader Pub Co., Ltd.	2000—375.9
CKCL	Toronto, Ontario, Dominion Battery Co., Ltd.	2000—356.9
CKCO	Ottawa, Ontario, Dr. G. M. Geldert	400—434.5

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Assistant Professor of Biology, New York University

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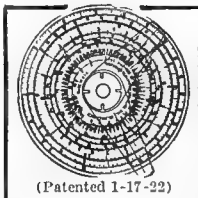

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6LV	Liverpool	315*
5SX	Swansea	310
6KH	Hull	320*
2EH	Edinburg	325*
	Dundee	331
5PY	Plymouth	335*
5NG	Nottingham	340*
2LS	Leeds	340*
5WA	Cardiff	351
2LO	London	365
2ZY	Manchester	375
6BM	Bournemouth	385
5NO	Newcastle	400
5SC	Glasgow	420
2BE	Belfast	435
5IT	Birmingham	475
2BD	Aberdeen	495
5XX	Chelmsford	1600
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PTT	Ecole Supdes P	458
	Petit-Parisien	345
	Agen	318
	Mont de Marsan	365
	Lyons	387
	Radio Sud-Est	340
	Nice (Radio Riviera)	360

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(Hongg)	Zurich	515
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H.B.2	Lausanne	1080

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(fr. Hamburg)	Hanover	296*
(fr. Hamburg)	Bremen	330*
(fr. Munich)	Nuremburg	340
	Hamburg	395
	Muenster	410
	Breslau	418
	Stuttgart	443
	Leipzig	454
	Koenigsberg	463
	Frankfurt	470
	Munich	485
(witzleben)	Berlin	500
(vox hans)	Berlin	505
L.P.	Koeningwusterhausen	
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(fr. Vienna)	Graz	404*
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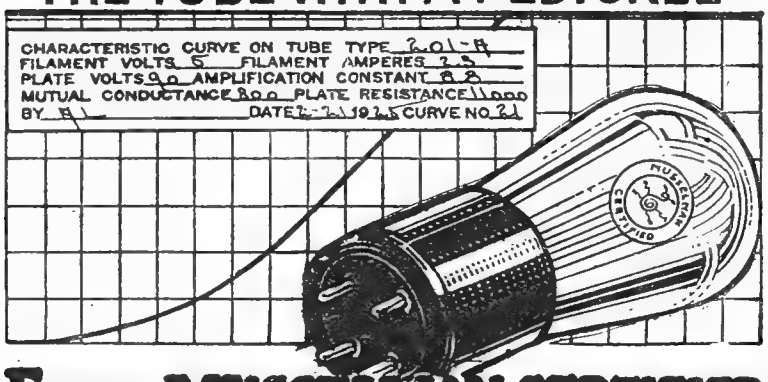
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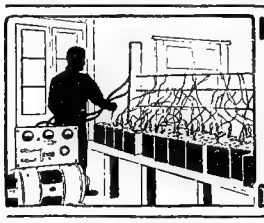

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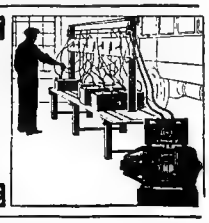

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3LO	Melbourne	1720
5KW	Brisbane	(under construction)

(Foreign stations compiled by M. Gibson, Reporter No. 16,883.—Ed.)

Important Articles to Appear In Oct. Issue of "The Experimenter"

Thermit Fusions for Experimenters.
By T. O'Conor Sloane, Ph.D.

Audio Frequency Amplifying Transformers.
By Theodore H. Nakken

A Broadcast Type Microphone.
Remote Control. By A. P. Peck

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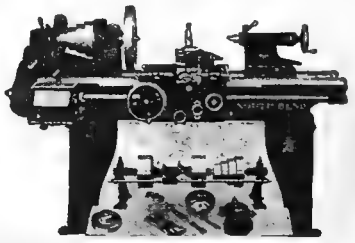

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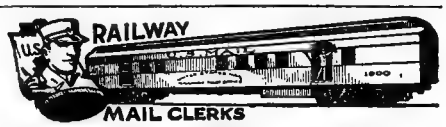

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Answers to Scientific Problems and Puzzles

(*Continued from page* 526)

THE DISTANCE BETWEEN THE POSTS

For simplicity let us suppose the men were driving only one mile per hour. Then, by the conditions of the problem, he should be 90 sec. traveling from one post to the next. But at this rate he should travel 90/3600 of a mile (since there are 3600 sec. in an hour) or one-fortieth of a mile which is 132 feet, the distance between the posts.

NOISY RADIATORS

The hammering that is sometimes heard in the pipes and radiators of a steam heating system is due to a column of water colliding with the end of a pipe or with a stationary body of water in the pipe. The water is driven along the pipe by the steam behind it. Ahead of the column some cooler steam condenses and the column is brought to an abrupt halt thereby imparting a severe jar to the pipe or radiator in which it was moving. Of course under ordinary circumstances there is enough air in the water to cushion the blow somewhat. But in a steam radiator the air has been boiled out and the liquid then transmits a blow to the pipe almost as if it were a solid bar.

BLOWOUTS ON HOT DAYS

To test the effect of temperature on the increase in pressure in a tire let us assume that we have the tires of a car inflated in the morning to 40 lbs. per sq. in. when the temperature is 20 degrees centigrade or 68 F. Then after the car has been driven awhile and the tires are hot, let us suppose the temperature of the air inside is 70 C. or 158 F. The gas laws tell us that the pressure will be proportional to the absolute temperature (assuming the volume to remain constant). Now 20 C. is 293° absolute and 70 C. is 343° A. So the ultimate pressure will be $40 \times 343/293$ or about 47 lbs. per sq. in. But an increase of only 7 lbs. per sq. in. would hardly account for an excessive number of blowouts, hence it seems more probable that they are due to the softening of the rubber and fabric that is quite noticeable in a hot tire.

REMOVING GREASE SPOTS

In removing a spot of grease from a cloth with ordinary cleaners such as benzine one should brush toward the center of the spot instead of across it because the surface tension of the solution of the grease in the cleaning fluid is such as to cause it to draw away from the benzine. As long as the benzine surrounds the spot, the grease will draw away from it toward the center and thus form a smaller and smaller spot, but if the cleaner gets within the spot it will cause it to spread and thus form a ring of grease of increasing radius.

THE MUSICAL NOTE FROM SPLASHING DROPS

Photographic studies of the splashes of water drops have shown that during the splash a small pocket is formed in the surface of the water into which the drop falls. This cavity acts as a resonating chamber and thus emits a musical note, the pitch of which depends upon the size of the hollow thus formed. The smaller the cavity the higher the note.

LOOPING THE LOOP

To safely loop the loop the speed of the rider at the top of the loop must be such that the centrifugal force holding him to the track at least equals that of gravity which tends to pull him down. This relation is given by the formula $WV^2/r = 32.2\ W$ in which W is the total weight of rider and

(*Continued on page* 587)

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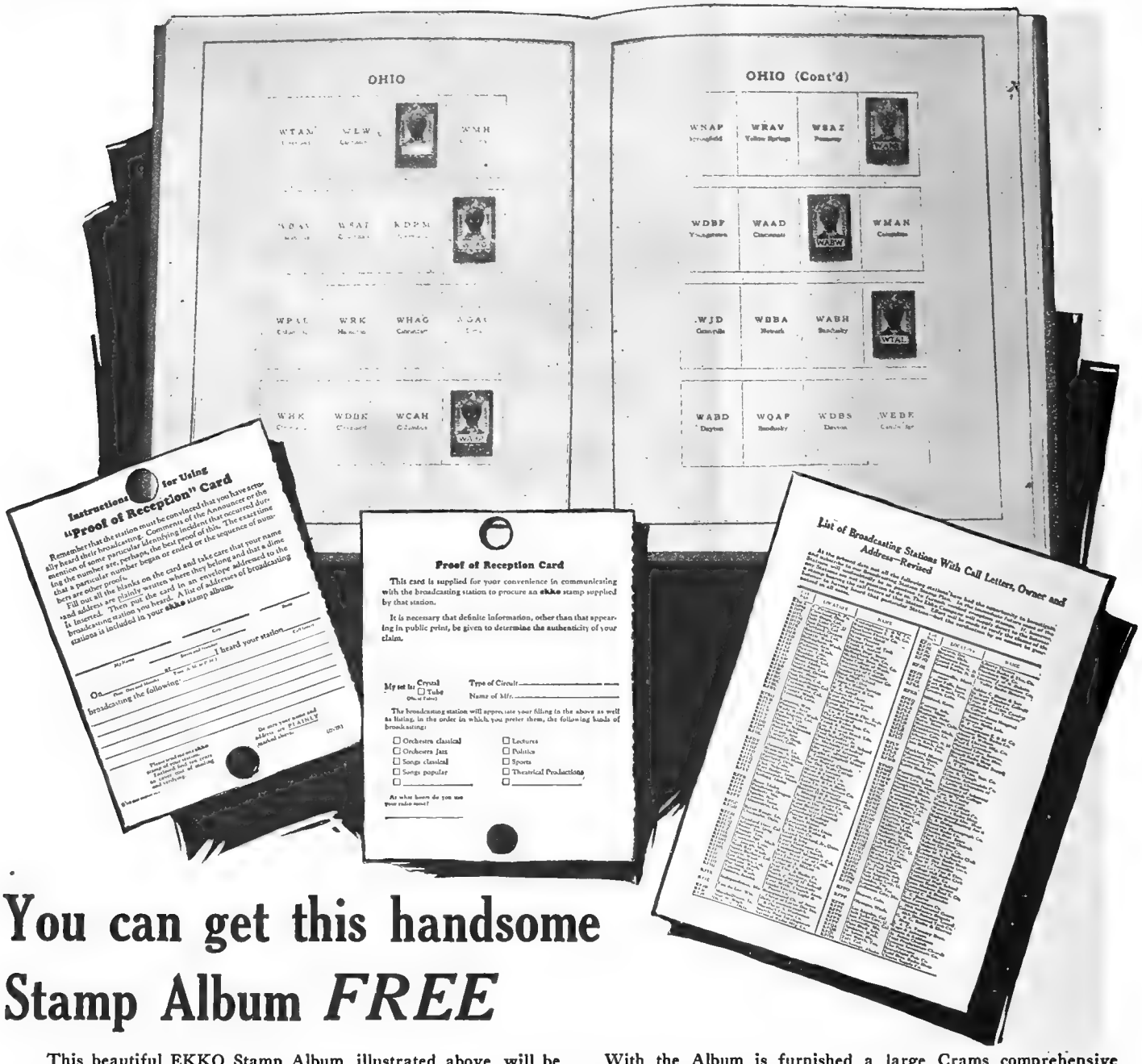
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Answers to Cross Number Puzzle

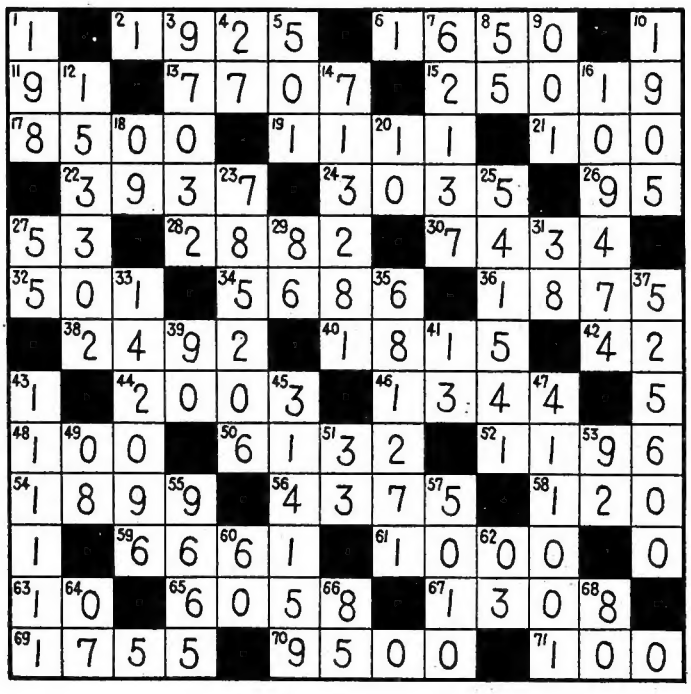
(Continued from page 527)

HORIZONTAL

2—1925.
6—16.50 feet.
11—XC plus 1 is 91.
13—60 by 80 by 1.6 is 7680 plus 27 is 7707.
15—24902 plus 117 is 25019.
17—MD is 1500 plus 7000 is 8500.
19—MCXI is 1111.
21—100 degrees.
22—39.37 inches.
24—MCX is 1110 plus 1925 is 3035.
26—The cube of 4.562 is 95.
27—53 years old on July 4th last.
28—Product of digits is 2880 plus 2 is 2882.
30—7434.
32—Prefix DI is 501.
34—5686.
36—1875.
38—2492.
40—1815.
42—Twice 21 shillings is 42 shillings.
44—MM is 2000 plus 3 is 2003.
46—1344.
48—"The Hundred Days."
50—Nautical mile is 6080 plus 52 is 6132.
52—119.6 square yards (metric).
54—1899.
56—28/64ths is .4375.
58—120 days.
59—1110 1/6ths by 6 is 6661.
61—1000.
63—10.
65—47.328 by 128 is 6058.
67—1320 minus 12 is 1308.
69—1755 (in the Deacon's One Hoss Shay).
70—57/60ths is .95.
71—100 degrees.

VERTICAL

1—198 inches.
3—97032.
4—27.
5—1925 divided by 3.85 is 500 plus one is 501.



7—.62137 of a mile.
8—55.
9—.001.
10—1905.
12—63360 by 2.4 is 152064 plus 1238 is 153302
14—704969 plus 8312 is 713281.
16—331 squared is 109, 561 less 87 is 109, 474.
18—.09.
20—10.
23—Digits product is 108864 by 7.213 is 785236 minus 30 is 785206.
25—45128 5/12ths by 12 ounces is 541, 541.
27—LI is 51 plus 4 is 55.
29—3 and 5/27ths by 27 is 86.
31—Two stone is 28 plus 10 is 38.
33—360 by 60 by 7 is 151200 less 9104 is 142096.
35—640 by 36 by 30 is 691200 minus 9929 is 681271.
37—60 by 24 by 365 is 525600.
39—90 minutes.
41—13.
43—IIIIII.
45—PI is 3.14159.
47—74 cubed is 405224 plus 5777 is 411001.
49—.08.
51—33 Feet.
53—92.
55—403 by 24 is 9672 less 7 is 9665.
57—1728 by 3 is 5184 minus 174 is 5010.
60—Vi is abbreviation. 6 by 10 is 60.
62—.03.
64—.07.
66—51/60ths is .85.
68—LXXX is 80.

Answers to Scientific Problems

(Continued from page 585)

cycle and r is the radius of the loop, 25 feet. From this formula we see that the critical velocity V at the top is independent of the weight W. In fact, it depends only upon r and the constant 32.2 which is the acceleration due to gravity. Solving for V we get 28.4 ft. per sec. for the minimum speed of the rider.

THE PROBLEM OF THE REVOLVING BALL

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THE DISTANCE BETWEEN THE ATOMS IN A CRYSTAL

The distance between the atoms in a crystal of common salt is 2,814 hundred millionths of a centimeter or a little more than one hundred millionth of an inch.

THE PERIOD OF A PENDULUM

Both experiment and theory indicate that the time for each swing of a simple pendulum is independent of the weight and material of the bob. It depends only upon the length of the pendulum and upon the gravitational constant at the place where the pendulum is suspended. Hence, neglecting friction, a lead bob and an aluminum bob will swing back and forth at an equal rate, provided the lengths of the pendulums are equal, if we neglect the resistance of the air. This will affecet an aluminum pendulum more than it will one of lead.

Feature Articles in October "Radio News"

The Behavior of Radio Waves
By Dr. E. F. W. Alexanderson

Dr. Alexanderson, whose name is well known to the public for his research work on radio wave propagation, discusses in an authorized interview with RADIO NEWS the recently discovered phenomenon of polarized radio waves.

Parlor Magic With Your Radio Set
By Hugo Gernsback

This is an extremely interesting article on novel ways of entertaining your friends with your radio set.

Does a Straight-Line Frequency Condenser Exist?
By Sylvan Harris

A further discussion on the latest developments of condensers that spread the dial readings at the lower end of the broadcast wave-length band.

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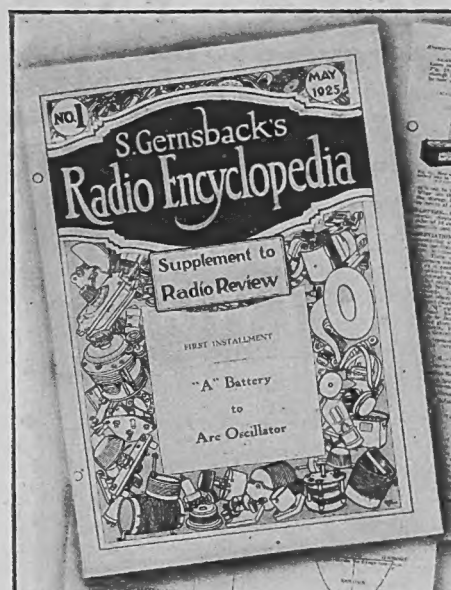

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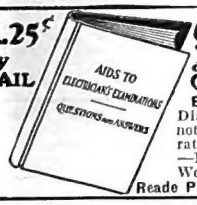

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The Radio Constructor

By A. P. PECK

(*Continued from page* 548)

consists of an exact counterpart of the antenna, stretched about 8 feet above the ground. It may run directly under the antenna, but this is not necessary. It can run in practically any convenient direction, although more often than not the easiest place to erect the counterpoise is in parallel with the antenna. The counterpoise and its lead to the set should be well insulated and a wise precaution is to provide two lightning switches for your entire antenna system. One is used to connect the aerial to the ground and the other to connect the counterpoise to the ground. The most important of these of course is the aerial grounding system, and many amateurs do not bother to use a lightning switch on a counterpoise. The reason for this is that the aerial is the highest metallic projection in the neighborhood, and therefore it will collect the greatest amount of atmospheric electricity.

OPERATING THE SET

Light the filament to normal brilliancy and then, listening in on your receiver, turn the oscillator dial on the transmitter. Before you do this, however, tune your receiving set to the wave upon which you desire to transmit. As the oscillator dial tunes the primary circuit to this wave-length, a distinct and loud plunk will be heard in the phones and possibly the detector tube in the receiving set will paralyze. When you have determined this point, tune your antenna condenser until your antenna meter shows a reading. The circuits are then in resonance and you can try to raise some nearby amateur, using the same methods that you have learned to be standard from listening in on amateur traffic. From then on, everything depends upon yourself. Study your transmitter and discover its peculiarities. Soon you will be well versed on the subject.

Hints for the Radio Builder, Part II

By LEON L. ADELMAN

(*Continued from page* 545)

The longer the antenna is, the more energy it will pick up and the more interference will be encountered.

On the other hand, it is not always possible for the radio enthusiast to erect an antenna. In this case, he should try a little stunt with the telephone. It will not in any way interfere with the service. Obtain a common pie pan, connect a long wire to it and the other end of the wire to the radio set (as in Fig. 5). Place the base of the telephone on the pie pan and with the ground connection made, you will be able to hear many stations.

BURNED-OUT TUBES

Burned-out tubes can be used as lightning arresters as in Fig. 6, and they may, after a fashion, be restored, by vigorous shaking with the "A" battery connected so as to weld the broken ends of the filament when they touch. It is best to disconnect the "B" battery before trying this experiment.

LOUD SPEAKERS

It is best, if one has several loud speakers, to connect them in series as in Fig. 7, rather than in parallel. This is for the reason that the same amount of current will be supplied to each and that if one of the speakers is inferior, it will not affect the operation of the others.

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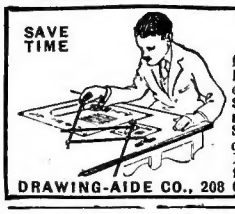

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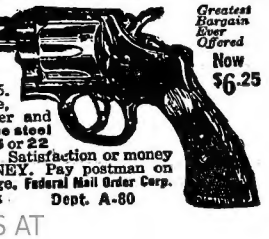

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